UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

WASHINGTON, D.C. 20460

OFFICE OF
PREVENTION, PESTICIDES
AND TOXIC SUBSTANCES

November 30, 2000

MEMORANDUM

SUBJECT: Occupational and Residential Exposure Assessment and Recommendations for the Reregistration Eligibility Decision (RED) Document for Diazinon. D270837. PC Code: 057801.

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Please find attached the revised occupational and residential exposure assessment for diazinon. This assessment addresses comments received during the Phase 3 Public Comment period, and incorporates the revised dermal endpoint of 1 mg/kg/day as a no-observed-adverse-effect level (NOAEL) for short, intermediate and long-term dermal exposures.

In addition, this assessment was revised to incorporate a recent registrant-submitted residential handler

exposure study, Occupational and Residential Exposure Task Force (OREFT) exposure data, and the most recent HED-recommended exposure assumptions and methodologies (e.g., updated Residential Standard Operating Procedure (SOP) assumptions for postapplication lawn exposures, and acres treated).

DP Barcode:

Pesticide Chemical Codes:	057801
EPA Reg Nos:	100-469 (G), 100-460 (WP), 100-258, 100-468 (G), 100-770 (SC), 100-784 (EC), 100-460 (WP), 100-463 (EC), 100-461 (EC)
EPA MRID No.:	402029-02; 404666-01; 443488-01, -02, -03, -04, & -06; and 449591-01, 451843-05;
PHED:	Yes, Version 1.1

1.0 EXECUTIVE SUMMARY

Diazinon [O,O-Diethyl O-(2-isopropyl-6-methyl-4-pyrimidinyl) phosphorothioate, is an organophosphate insecticide currently registered for the control of various insects. Targeted pests include fleas, ticks, cockroaches, cutworms, grasshoppers, aphids, etc. Registered use sites include sorghum, corn, cotton, citrus, nut crops, cole crops, pome and strawberry fruits, field and vegetable crops, ornamental plants, mushroom houses, sheep, livestock premise treatments, and ear tags. It can also be used in greenhouses, although the registrant has voluntarily agreed to delete this use. There are a wide range of application rates. Typical vegetable crop rates range from foliar application of 0.5 lb ai/acre to soil incorporated rates up to 4 lb ai/acre; granular applications up to 4 lb ai/acre; greenhouse up to 0.08 lb ai/gal; and fruit tree and nut tree (almonds and walnuts) up to 2 and 3 lb ai/acre, respectively. Information on application rates was obtained from product labels and the Biological Assessment Exposure Division (BEAD) (Quantitative Usage Analysis from Diazinon, memo from A. Halvorson 1/29/99). A multitude of application rates have also been assessed to provide additional characterization and to give the risk managers more information for risk management decisions.

All occupational and residential uses, including agricultural, animal premise, greenhouse uses, commercial lawn and ornamental treatments, residential/commercial indoor uses, in additional to resident applied uses are evaluated in this document. For the purposes of this chapter, relevant diazinon formulations include wettable powders, granular, impregnated ear tags, microencapsulated, and soluble concentrate/liquids.

In July 2000, the registrants agreed to discontinue to support the registration of indoor uses. This includes use inside any structure or vehicle, vessel, or aircraft and/or on any contents therein.

The toxicity endpoints used in this document to assess hazards in include short-, intermediate- and long-term dermal and inhalation endpoints and a short-term oral endpoint. A no-observed-adverse-effect level (NOAEL) of 1 mg/kg/day from a dermal toxicity study was used to assess dermal exposures (all durations), while a lowest-observed-adverse-effect level (LOAEL) of 0.026 mg/kg/day from an inhalation toxicity study was selected to assess inhalation exposures (all durations). Because route-specific toxicity studies are available, dermal and inhalation absorption factors are not necessary. The short-term oral NOAEL of 0.25 mg/kg/day was used to assess incidental ingestion (i.e., hand to mouth exposures) of less than one week for children. This is considered appropriate because exposures and risks are calculated for the day of application, when residential exposures are expected to be greatest. This oral NOAEL was also used to estimate risks when biomonitoring measurements (i.e., absorbed dose estimated from urinary metabolites of diazinon) were available. Cholinesterase inhibition (plasma, red blood cell and/or brain) is the critical effect for all routes of exposure. Oral exposures were not evaluated for workers or adult residents. The exposure duration for short-term assessments is 1 to 7 days. Intermediate-term durations are 1 week to 6 months, and long-term exposures are durations greater than six months.

For the dermal and inhalation risk assessments, risk estimates are expressed in terms of the Margin of Exposure (MOE), which is the ratio of the NOAEL or LOAEL selected for the risk assessment to the

exposure. Target margins of exposure (MOEs) for short-term dermal risk assessments are 100 resulting from the following uncertainty factors: a 10x for inter-species variability and 10x for intra-species extrapolation. A target MOE of 300 is applicable for the intermediate- and long-term dermal endpoints based on the inter- (10X) and intra-species factors (10X), in addition to a 3X to extrapolate from a 21-day dermal study to longer-term exposures. For inhalation risk assessments (all time periods) the target MOE is 300x resulting from the inter- (10x) and intra-species (10X) factors, and for lack of a NOAEL in the critical study and consequent use of a LOAEL (3x). The FQPA factor was reduced to 1X, therefore the same target MOEs are applicable to both occupationally exposed workers and adult and child residents.

Multiple exposure studies were conducted by the registrant and submitted to the Agency that evaluate exposures to PCOs/residential handlers and residents following application of diazinon products. These data include biological monitoring, passive dosimetry and environmental measurements. These data, along with supplemental data from the Pesticide Handlers Exposure Database (PHED) Version 1.1, were used to assess potential agricultural exposures and PCO/LCO exposures resulting from handling and applying diazinon in residential settings. Postapplication residential exposures were assessed using primarily the registrant-submitted data. In the absence of data, the Draft Standard Operating Procedures (SOPs) for Residential Exposure Assessments (December 18, 1997), in addition to assumptions for the updated SOPs, many of which were presented the to the FIFRA Scientific Advisory Panel (SAP) in September 1999, were used to estimate exposures. Exposures associated with all uses of diazinon products have not been monitored. Therefore, the available data were used to evaluate similar uses (i.e. residential crack and crevice exposure data used to evaluate similar treatments in other buildings such as schools, day care centers, the workplace, etc).

HED is in the process of revising the residential exposure assessment SOPs. This process may identify specific areas of further concern with respect to diazinon and exposure to the general population. For example, some of the secondary exposure pathways that EPA will be addressing include exposures resulting from residue tracked into homes from outdoor use, indoor dust, and spray drift.

HED has concerns for the potential for children's exposure in the home as a result of residential and/or agricultural uses of diazinon. Environmental concentrations of diazinon in homes may result from residential uses, spray drift, track-in, or from redistribution of residues brought home on the clothing of farm workers or pesticide applicators. Potential routes of exposure for children may include incidental ingestion and dermal contact with residues on carpets/hard surfaces, in addition to inhalation of vapor and airborne particulates. There are several literature studies that quantify the levels of diazinon in household dust, indoor and outdoor air, dermal wipe (hands) and soil samples (Gordon et al. 1999). These residues may persist and the resulting exposures are of a potential chronic nature. Currently, there are no SOPs available to evaluate potential exposures from spray drift and track-in. These scenarios however, may be evaluated in the future pending revisions to the residential SOPs.

Occupational Exposure and Risk: Occupational exposures to diazinon can occur during handling, mixing, loading and application activities. Occupational postapplication exposure can occur for agricultural workers during scouting, irrigation, cultivation, harvesting and handling seeds.

Based on toxicological criteria and potential for exposure, HED has conducted dermal and inhalation exposure assessments for occupational handlers exposed to diazinon and dermal exposure assessments for occupational postapplication to diazinon. Inhalation is not expected be a significant postapplication exposure route, except for possibly handling treated seeds for planting, for which limited non-chemical-specific data are available. The duration of exposure is expected to be short-, and intermediate-term for both occupational handler, and postapplication exposures during agricultural and harvesting activities. In addition, there is a potential for long-term exposure with 10 handler scenarios.

Dermal and inhalation exposures were combined because of a common toxicity endpoint (i.e., cholinesterase inhibition), and because dermal and inhalation exposures may occur simultaneously. An aggregate risk index (ARI) was used to combine short-term dermal and inhalation risk estimates because the dermal and inhalation target MOEs are different (i.e., 100 for dermal and 300 for inhalation). An ARI of less than one exceeds HED's level of concern. However, a total MOE was calculated for intermediate- and long-term exposures because the target MOE is 300 for both dermal and inhalation exposure. For intermediate- and long-term aggregate exposure, an MOE of less than 300 exceeds HED's level of concern.

The majority of **occupational risk estimates for handlers** exposed to diazinon exceed HED's level of concern, even with PPE and/or engineering controls. HED identified 32 major handler scenarios, which when combined with a range of application rates resulted in 76 iterations within 32 scenarios. The results of the agricultural handler assessments indicate that none of the potential exposure scenarios provide ARIs $1 for short-term durations or total dermal and inhalation MOEs greater than or equal to 100 and 300, respectively for intermediate and long-term durations at baseline attire (i.e., long pants, long sleeved shirts, no gloves). Only 5 of the short-term scenarios quantitatively evaluated using personal protective equipment (PPE) (long sleeved shirt, long pants, shoes, socks, chemical-resistant gloves, and dust/mist respirator) or by using engineering controls (e.g., closed mixing systems or enclose cabs) have a ARIs $1, while only 4 scenarios have total dermal and inhalation MOEs $300. There are insufficient data to adequately assess the sheep treatments and mushroom houses, and additional data are requested to support these uses. The agricultural handler assessments are believed to be reasonable representations of diazinon uses. Surrogate Pesticide PHED data were used to assess handler exposure because no chemical specific studies are available, except for one study that evaluated application of dust formulation by a pest control operator (PCO) (MRID 44348801).

The results of the short- and intermediate-term **dermal postapplication assessments** for workers exposed to diazinon for most agricultural, and greenhouse activities indicate that MOEs are less than 100 at the current Worker Protection Standard (WPS)-required restricted entry interval (REIs) of 24 hours. Therefore, the majority of postapplication exposures exceed HED's level of concern. The MOEs for postapplication workers did not reach MOEs of 100 for 2-6 days after treatment for most vegetable crops, 3-8 days for fruit trees, 3-9 days for field crops, 3-7 days for berries, 6-8 days for ornamentals and 4-8 days for grapes. The REIs were based exclusively on dermal exposures because potential inhalation exposures were determined to be negligible in comparison. The potential for dermal contact during postapplication activities (e.g., harvesting) is assessed using a matrix of potential dermal contact rates by activity and associated crops. Chemical-specific dislodgeable foliar residue (DFR)

data were submitted for cabbage and oranges. These data were used along with HED standard transfer coefficients to assess potential exposures to workers reentering treated sites. The occupational postapplication assessment is believed to be reasonably representative of diazinon uses, except for nut trees and outdoor ornamental uses.

Uncertainties in this analysis include: the use of a linear extrapolation applied to the DFR values from the study application rate (1 lb ai/A) to the maximum labeled rate (3 lbs ai/A) for tree crops; and the use of the available cabbage and citrus DFR values to estimate DFRs for other crops. The effect of extrapolating the cabbage and citrus DFR data to a higher application rate and using it to represent other crops is unknown and may under- or overestimate the actual residue levels.

Residential Handler Risk Estimates: Most of the residential handler risk estimates exceeded the levels of concern (i.e., MOE s < 100 for dermal, < 300 for inhalation and ARI <1 for combined exposure). HED evaluated exposures to residential handlers during mixing, loading and application to turf. The duration of exposure is short-term for residential handlers. The following scenarios result in ARIs or MOEs that exceed HED's level of concern (i.e., ARI < 1 for passive dosimetry, MOE <100 for biomonitoring):

- Spot Treatment of Turf by a residential mixer/loader/applicator using a low pressure handwand based on passive dosimetry (ARI=0.25-0.38);
- Spot Treatment of Turf by a residential mixer/loader/applicator using a back pack sprayer (ARI=0.89);
- Spot Treatment of Turf by a residential mixer/loader/applicator using a belly grinder (ARI=0.059);
- Broadcast Turf Treatment by a residential mixer/loader/applicator using a ready-to-use garden hose-end sprayer to treat 0.5 acres (ARI=0.051-0.09 based on passive dosimetry, and total MOE=94 based on biomonitoring);
- Broadcast Turf Treatment by a residential mixer/loader/applicator using a conventional hose-end sprayer to treat 0.5 acre (ARI=0.03-0.058 based on passive dosimetry and total MOE=60 based on biomonitoring) and 0.11 acre (5000 ft^2) (MOE=27 for 90th percentile biomonitoring data); and
- Application of Granular Formulations by a residential applicator using a push-type spreader to treat 0.344 acres (15,000 ft^2) and wearing short pants (ARI=0.59).

The following scenarios result in MOEs greater than 100 (based on biomonitoring results) that do not exceed HED's level of concern for residential handlers:

- Spot Treatment of Turf by a residential mixer/loader/applicator using a low pressure handwand based on biomonitoring (MOE=300 for mean, and 180 for 90th percentile);
- Broadcast Turf Treatment by a residential mixer/loader/applicator using a ready-to-use garden hose-end sprayer to treat 0.11 acres (5,000 ft^2) based on biomonitoring (MOE=410 for mean and 110 for 90th percentile);
- Broadcast Turf Treatment by a residential mixer/loader/applicator using a conventional hose-

end sprayer to treat 0.11 acre (5,000 ft^2) based on biomonitoring (MOE=260 for mean only); and

- Application of Granular Formulations by a residential applicator using a push-type spreader to treat 0.344 acres (15,000 ft^2) and wearing long pants (ARI=2.4).

The results of the residential handler assessment for short- term exposure scenarios indicate that all six of the scenarios evaluated have total risk estimates that exceed HED's level of concern defined by a target ARI of 1 (or MOE of 100 for biomonitoring results) using current HED default assumptions (i.e. short pants and 0.5 acre lawn size). The residential handler MOEs ranged from 3 to 520 for dermal risk, from 20 to 1,300 for inhalation risk, and total ARIs range from 0.03 to 2.4. For a number of scenarios, multiple evaluations were conducted using lawn size less than the 0.5 acre default (0.11 to 0.34 acres), or application using different equipment or methods (i.e., ornamental treatment via low pressure hand wand and hose-end sprayer, and granular application via belly grinder and push-type spreader) to provide information for risk mitigation and management decisions.

The registrant submitted one chemical-specific handler study that assessed three residential handler application scenarios (MRID 45184305), which was utilized to the greatest extent possible. This study conducted both biomonitoring (i.e., urinary measurement of a unique diazinon metabolite, G27550) and/or passive dosimetry measurements on 42 different residential applicators. In addition, passive dosimetry exposure data from a recently submitted Occupational and Residential Exposure Task Force (ORETF) handler study were used. This study assessed residential handler exposures to diazinon resulting from a conventional hose-end sprayer (dial type sprayer) and a ready-to-use hose-end sprayer (MRID 44972201). The same ORETF study (MRID 44972201) assessed residential handler exposures to dacthal resulting from a granular push-type spreader. This study was used as a surrogate to assess diazinon. In the absence of chemical-specific data, HED relied on information from the Draft Residential Standard Operating Procedures (SOPs - December 1997), and updated assumptions (2000 SOPs). The Residential SOPs were used to assess the backpack sprayer and the belly grinder exposure scenarios. The residential unit exposure numbers are derived from the Pesticide Handler Exposure Database (PHED) Version 1.1. Dermal Unit Exposures are based on homeowner applicators wearing short sleeve shirts and short pants, and no gloves, open mixing/loading; except for backpack sprayers (which includes chemical resistant gloves), in accordance with current Agency policy. Inhalation Exposure Unit estimates assume no respirator. For information purposes, HED also evaluated residential handlers wearing long pants for the push-type granular spreader. The dermal MOEs for this scenario with short pants and long pants are 68 and 520, respectively, indicating that the majority of the dermal exposure is to the lower legs. HED policy is to only assume residents wear short pants because it is difficult to enforce protective clothing requirements for homeowners. HED notes the following granular labels (EPA Reg No. 239-2479, 100-468) do not recommend the applicator wear long pants.

For several residential handler scenarios, HED evaluated exposures and risks using both passive dosimetry and biomonitoring data from the same study. HED evaluated the biomonitoring data at both the central tendency (mean) and 90th percentile exposure estimates as measured in the study (i.e., treatment of 5,000 ft^2) because these exposures reflect actual measurements, and are not extrapolated

or combined with default or high-end assumptions to estimate risks. In addition, HED extrapolated the passive dosimetry and biomonitoring data from 0.11 acres (as measured in the registrant study) to 0.5 acre in accordance with current Agency policy. In this instance, only the central tendency biomonitoring exposure estimates were presented (i.e., 90th percentile exposures are not extrapolated). As noted previously, all risk estimates for residential handlers that treat a 0.5 acre lawn size exceed HED's level of concern. The biomonitoring data represent total exposure, because they are based on a total absorbed dose resulting from primarily dermal and inhalation exposure. While biomonitoring data are typically preferred for assessing exposures, HED believes the biomonitoring results for diazinon may underestimate exposure and risk primarily due to possible incomplete urine collection for some individuals (at least 9 of 42 individuals, appeared to have low urine volumes), in addition to lack of pharmacokinetic data for the G-27550 metabolite following dermal exposure. For these reasons, Canada's Pest Management Regulatory Agency (PMRA) does not consider the biomonitoring results to be acceptable for use in generating handler exposure estimates.

An important factor that contributes to the possible over-estimation of risk is that a 21 day inhalation toxicity endpoint based on whole body exposure in rats, and a 21 day dermal toxicity endpoint in rabbits were used to assess a short-term (hours to a single day) exposure scenarios.

Residential Postapplication Risk Estimates. The majority of the postapplication risk estimates for children and adults exceed HED's level of concern for (i.e., MOE s < 100 for short-term dermal, < 300 for inhalation and longer-term dermal and ARI <1 for combined exposure). HED evaluated postapplication exposures to residues by adults and children on treated turf, in residences following crack and crevice treatments and from pet collar use. The duration of exposure is short-term for post application exposures, except pet collar use which is considered intermediate- and possibly long-term exposure.

The following postapplication scenarios result in short-term ARIs < 1 or intermediate- and long-term MOEs < 300 and therefore, result in exposures that exceed HED's level of concern:

- Broadcast Turf Treatment Using a Liquid Formulation for children (ARI=0.03 to 0.04);
- Broadcast Turf Treatment Using a Granular Formulation for children (ARI=0.04);
- Indoor Crack and Crevice Treatment for children and adults (inhalation MOEs=1.2-380, dermal MOEs= 0.04-2); and
- Pet Collar Products (dermal MOEs=45-120 for children, 210-590 for adults).

As noted previously, in July 2000, the registrants agreed to discontinue to support the registration of indoor uses, including crack and crevice treatment, and pet collar use. Nevertheless, these scenarios are presented for a complete assessment.

The results of the residential postapplictation exposure scenarios indicate that all four of the scenarios evaluated have risk estimates of concern (i.e., ARIs < 1 or MOEs < 300). For postapplication lawn treatment exposures, HED evaluated the following six exposure pathways: dermal, hand-to-mouth, turf mouthing, soil ingestion, inhalation and granule ingestion. While the combined exposure of these

scenarios results in an ARI of less than 1 (excluding granule ingestion which is considered episodic), several individual exposure pathways do not exceed the appropriate target MOE except for three pathways. Exposure pathways of concern are hand to mouth exposures for children (MOEs=3.8-4.2) for both liquid and granular treatments, most inhalation exposures to children following liquid treatment immediately after application (0-4 hours) (average MOEs=76-330), and ingestion of granules (MOE=0.26). HED evaluated risks associated with both watered-in and non-watered in lawn treatment to assist risk management decisions, although the label only requires watering-in for granular products. The available data suggest that the risks associated with watered-in lawn treatment are lower than non-watered in treated lawns.

It is HED's policy to routinely conduct screening level assessments (based on standard values in the Residential SOPs) for children's incidental ingestion of granules when a granular pesticide may be applied in residential settings. The screening-level assessment for diazinon resulted in an MOE of 0.26 and is a risk of concern. Information on particle density (number of particles per pound or gram), carrier type (corn cob, clay), granular color, and average granular size is requested from the registrant in order to refine this screening level assessment.

The ARI for children is conservative because it assumes a child is simultaneously conducting hand to mouth activities, ingesting soil and grass, dermally contacting the treated lawn and breathing diazinon residues in air the day of lawn treatment. Therefore, HED also evaluated aggregate dermal and inhalation exposures for children to evaluate the impact of excluding the oral pathways. The dermal and inhalation ARIs for the liquid formulation are mostly less than 1 (ARIs range from 0.2 to 1.24). However, the ARIs for granular turf treatment are mostly greater than 1 (ARIs range from 0.59 to 5), and therefore, do not exceed HED's level of concern.

The post-application lawn assessment is based primarily on chemical-specific data from the Turf Transferable Residue (TTR) Study submitted by the registrant, Novartis, in December 1999 (MRID 44959101). This study measured TTRs and air concentrations on the day of lawn treatment for both granular and liquid formulated products. The crack and crevice assessment is based on a chemical-specific study submitted by the registrant (MRID 4434801). In addition, HED relied on generic assumptions as specified by the Draft Residential SOPs, updated Residential SOPs (2000) and recommended approaches by HED's Exposure Science Advisory Committee (ExpoSAC) to assess children contacting recently treated turf and dermal exposures following crack and crevice treatment and pet collar use. The SOPs use a high contact activity based on the use of Jazzercise® to represent the exposures of an actively playing child. The proposed assumptions are expected to better represent residential exposure and are still considered to be high-end, screening level assumptions.

There are uncertainties in the risk estimates that could over- or under-estimate the risks associated with postapplication lawn exposure. For example, the most important factors that contribute to the possible over- or under-estimation of risk are: (1) use of a 21 day inhalation toxicity endpoint based on whole body exposure in rats, or a 21 day dermal toxicity endpoint to assess a 2 hour lawn exposure scenario; (2) assumption that individuals contact treated turf the day of treatment (after the turf has dried for dermal and oral pathways), or inhale the volatilized residues immediately after treatment for inhalation

(i.e., between 0 and 4 hours post application); (3) assumption that 5% of the application rate is available for transfer to hands from foliage (to account for wet or sticky hands) based on USEPA data (Clothier 1999), when turf transferable residue (TTR) data show only 0.049% is transferred onto dry cotton cloths (4) use of an inhalation rate of 0.7 m^3/hr for children 1-6 years of age, when there are few data available on this parameter for children less than 3 year. Although protective, this breathing rate could underestimate exposure and risks to children 6 years or age and older involved in moderate activities such as playing baseball, soccer, etc. for more than 1 hour the day of treatment; (5) the inhalation risk estimates are based on aerosol concentrations only and exclude vapor residues, which could be significant during volatilization; (6) this assessment does not assess potential exposures to all environmental metabolites; and (7) use of average air concentrations across three geographic locations to assess inhalation risk estimates for liquid turf treatments.

It should be noted that the diazinon air residues declined substantially (2-10 fold of initial air levels) within 8 hours of turf treatment for liquid formulation. In addition, the turf transferable residues dissipated rapidly over time, with residues non-detectable within 2 days postapplication. Therefore, the exposure and risk estimates on day 2 postapplication would be significantly less than the day of treatment exposure and risk estimates presented in this assessment.

In addition, the Residential SOPs are considered to be conservative scenarios for determining risk estimates. The adult and toddler transfer coefficients are based on the Jazzercise protocol and an upper percentile exposure duration value of 2 hours/day. The dermal exposure estimates, however, are more refined because they are based on actual TTR data compared to the incidental ingestion scenarios which are based on estimated Dislodgeable foliage residues (DFR), and grass and soil concentrations.

2.0 BACKGROUND

Purpose

In this document, which is for use in EPA's development of the Diazinon Reregistration Eligibility Decision Document (RED), EPA presents the results of its regulatory review of agricultural, commercial and residential exposure to diazinon. The assessment of the *potential* human health effects are based on scenarios where the pesticide label's maximum recommended application rates are used for a full days work. Additional rates are also included to better characterize the risks associated with what may be the most predominately used rates in the field. The maximum rates are always assessed because by approving a label, the Agency is in effect sanctioning its use as stipulated on the label. The maximum rates are also assessed to determine if risk mitigation is necessary for risk estimates that exceed HED's level of concern. Historically, diazinon dermal exposure was assessed using a human toxicologically derived endpoint with a 10-fold safety factor for intra-species variation. The Agency's current policy is to use animal toxicity data and thus an additional 10-fold uncertainty factor is applied for interspecies extrapolation.

Criteria for Conducting Exposure Assessments

An occupational exposure assessment is required for an active ingredient if (1) certain toxicological criteria are triggered and (2) there is potential exposure to handlers (mixers, loaders, applicators, etc.) during use or to persons entering treated sites after application is complete. For diazinon both criteria are met.

2.1 Summary of Toxicity Concerns

Acute Toxicology Categories

Table 1 presents the acute toxicity categories as outlined in the Report of the Hazard Identification Assessment Review Committee dated November 6, 2000 (HED Doc. No. 014369).

Table 1. Acute Toxicity Categories for diazinon

Study Type	Toxicity Category
Acute Oral Toxicity	**III**
Acute Dermal Toxicity	**II**
Acute Inhalation Toxicity	**III**
Primary Eye Irritation	**IV**
Primary Dermal Irritation	**IV**
Dermal Sensitization	**Not a sensitizer**

Other Endpoints of Concern

The Report of the Hazard Identification Assessment Review Committee dated November 6, 2000 (HED Doc. No. 014369), indicates that there are toxicological endpoints of concern for diazinon. The endpoints, and associated uncertainty factors, used in assessing the risks for diazinon are presented in Table 2.

As shown on Table 2, a dermal NOAEL of 1 mg/kg/day was used to assess dermal exposures (all durations), while an inhalation LOAEL of 0.026 mg/kg/day was selected to assess inhalation exposures (all durations). Because route-specific toxicity studies are available, dermal and inhalation absorption factors are not necessary. Target margins of exposure (MOEs) for short-term dermal risk assessments are 100 resulting from the following uncertainty factors: a 10x for inter-species variability and 10x for intra-species extrapolation. A target MOE of 300 is applicable for the intermediate- and long-term dermal endpoints based on the inter- (10X) and intra-species factors (10X), in addition to a 3X to extrapolate from a 21-day dermal study to longer-term exposures. For inhalation risk assessments (all time periods) the target MOE is 300 resulting from the inter- (10x) and intra-species (10X) factors, and for lack of a NOAEL in the critical study and consequent use of a LOAEL (3x).

Table 2. Diazinon Hazard Endpoints and Uncertainty Factors.					
Route / Duration	**NOAEL or LOAEL (mg/kg/day)**	**Effect**	**Study**	**Target MOE**	**Comments**
Short-term incidental oral exposure	NOAEL = 0.25	Significant plasma cholinesterase inhibition at 2.5 mg/kg/day	Rat acute neurotoxicity and rat acute special study	MOE = 100 for all populations (10x interspecies, 10x intraspecies, and 1X FQPA factor for residents)	
Short, intermediate- and long-term Dermal	NOAEL = 1	Significant serum and brain cholinesterase inhibition at 5 mg/kg/day	21-day dermal rabbit study	short-term MOE = 100 for all populations (10x inter- and 10x-intraspecies factors; 1X FQPA for residents); IT and LT MOE = 300 for all populations (includes additional 3x for duration of exposure, and 1X FQPA for residents)	Dermal absorption factor not necessary
Short-, Intermediate- and Long-term Inhalation	LOAEL = 0.026 (0.1 µg/L)	Significant plasma and RBC cholinesterase inhibition at 0.026 mg/kg/day	21-Day whole body rat inhalation study (6 hours/day)	MOE = 300 for all durations and populations (includes additional 3X for selection of a LOAEL, and 1X FQPA factor)	Inhalation absorption factor not necessary

IT - Intermediate-term
LT= long-term
RBC= red blood cell

2.2 Summary of Use Pattern and Formulations

Diazinon [O,O-Diethyl O-(2-isopropyl-6-methyl-4-pyrimidinyl) phosphorothioate, is an organophosphate insecticide currently registered for the control of various insects. Targeted pests include fleas, ticks, cockroaches, cutworms, grasshoppers, aphids, etc. Registered use sites include sorghum, corn, cotton, citrus, nut crops, cole crops, pome and strawberry fruits, field and vegetable crops, ornamental plants, sheep, livestock premise treatments, mushroom houses, and ear tags. It can also be used in greenhouses, although the registrant has voluntarily agreed to delete this use. There are a wide range of application rates. Typical vegetable crop rates range from foliar application of 0.5 lb ai/acre to soil incorporated rates up to 4 lb ai/acre; granular applications up to 4 lb ai/acre; greenhouse up to 0.08 lb ai/gal; and fruit tree and nut tree (almonds and walnuts) up to 2 and 3 lb ai/acre, respectively. Table 3 provides more detailed information on application rates, EPA Reg. Nos., crops, and associated application equipment types. Information on application rates was obtained from product labels and the Biological Assessment Exposure Division (BEAD) (Quantitative Usage Analysis

from Diazinon, memo from A. Halvorson 1/29/99). A multitude of application rates have also been assessed to provide additional characterization and to give the risk managers more information for risk management decisions.

All occupational and residential uses, including agricultural, animal premise, greenhouse uses, commercial lawn and ornamental treatments, residential/commercial indoor uses, in additional to resident applied uses are evaluated in this document. For the purposes of this chapter, relevant diazinon formulations include wettable powders, granular, impregnated ear tags, microencapsulated, and soluble concentrate/liquids.

In July 2000, the registrants agreed to discontinue to support the registration of indoor uses. This includes use inside any structure or vehicle, vessel, or aircraft and/or on any contents therein including, but not limited to:

A: Inside domestic residences and dwellings (such as houses, apartments, or trailers) or any use therein such as interior surfaces (including associated cracks, crevices, or voids), furnishings (including furniture, rugs, carpeting, and underlayment), houseplants indoors, garbage cans or containers indoors, utility rooms, laundry rooms, drains of any type (including floor drains, sinks or toilets), and in any associated structures or outbuildings such as garages, enclosed porches, crawlspaces (including crawlspaces under raised porches), sheds, and work or hobby buildings.

B. Inside any commercial, industrial or institutional building or structure such as schools (including temporary structures such as trailers), hospitals, retirement homes, nursing homes, hotels, motels, motor courts, military buildings and barracks, offices, shops, stores, shopping malls, garages, warehouses or any storage facilities, manufacturing facilities, repair facilities, both feed/food and non-food/non-feed areas of food/feed handling establishments (including eating establishments such as restaurants, cafeterias and dining halls, canneries, bakeries, meat processing plants, mills, egg processing plants, dairies, and food marketing/storage and/or distribution facilities), athletic or sports facilities, recreation buildings, libraries, museums, and any other private or public buildings and any use therein, such as interior surfaces (including associated cracks, crevices, and voids), furnishings (including furniture, work surfaces or equipment, electrical boxes indoors, rugs, carpeting or underlayment), houseplants indoors, interiorscapes (interior plantscapes, indoor decorative plantings), garbage cans or containers indoors, waste storage areas indoors, utility/mechanical/boiler rooms, locker rooms, storage rooms, lavatories (restrooms, toilet areas), drains of any type (including floor drains, sinks or toilets), crawlspaces, and in any associated structures or outbuildings.

C. Inside any enclosed agricultural building or structure, such as any enclosed livestock living, sleeping, or loafing quarters including barns (but excluding outdoor livestock pens and corrals), enclosed loafing sheds, hog houses, storage buildings, sheds, garages and any other farm buildings.

D. Use in any transportation vehicle including buses, trucks, trailers, containers, ships, boats, barges or other vessels, aircraft, railroad cars (including freight or passenger), or inside any buildings associated with transportation such as bus and train stations, airports, or ports.

E. Dog or cat collars, or in enclosed pet sleeping or living quarters including inside domestic residences, commercial, industrial, institutional or agricultural buildings, veterinary buildings, doghouses, and kennels (but excluding outdoor animal runs and training or exercise areas).

F. Inside greenhouses (including home or commercial)(but excluding shade houses and lath houses) on any surface including on and under benches, and on any plants contained therein.

2.3 Method and Types of Equipment Used for Mixing/Loading/Applying

The Agency determines potential exposures to pesticides handlers by identifying exposure scenarios from the various application equipment-types that are plausible given the label uses. It is HED's responsibility to assess all uses that are allowable/plausible based on the label. Therefore, in all cases, the maximum labeled rates are assessed. If these maximum rates do not reflect actual practice, then those rates should be removed from the labels. The frequency that the maximum labeled rates are used may be important information to the risk manger during the Agency's risk mitigation phase.

Based on reviewing pesticide labels and professional judgement, the use patterns specific to diazinon are associated with the following application equipment:

- Aerial (Spray) Equipment: foliar applications to fruit trees, walnuts, cranberries, field crops (e.g., sorghum, corn), vegetable crops (cole, cucurbits, root, fruiting and leafy), and field grown nursery crops.
- Chemigation Equipment: cranberries
- Groundboom Equipment: strawberries, field crops, and vegetable crops (cole, cucurbits, root, fruiting and leafy).
- Airblast Equipment: fruit & nut tree foliage, grapes, and hops.
- Backpack/Low Pressure Handwand Equipment: field grown nursery crops, animal premises and pest control operators (PCOs).
- High Pressure Handwand Equipment: livestock areas, greenhouse ornamentals.
- Hydraulic Sprayer with Handgun: rights-of-way type sprayer.
- handheld spray equipment (handgun sprayer used by lawn care operators).
- Paintbrush: fly control in livestock areas.
- Airless Sprayer: fly control in livestock areas.
- Seed treatment: corn
- Belly Grinder: lawn treatment
- Push-type granular spreaders: lawn treatment.
- Sprinkler can: sheep treatment (insufficient exposure data available to assess this use).

3.0 HANDLER EXPOSURES

3.1 Handler Exposures & Assumptions

EPA has determined that there are potential exposures to mixers, loaders, applicators, or other handlers during usual use-patterns associated with diazinon. Based on the use patterns and potential exposures described above, 32 major occupational exposure scenarios (including: agricultural, animal premise, greenhouse, and/or commercial handler exposures) are identified to represent the extent of diazinon uses. Throughout the document the reference to these exposure scenarios are numerically organized (i.e., scenarios numbered 1 to 9). The mixer/loader scenarios are further denoted within each formulation by application type to account for the area treated (e.g., 1a mixing liquids for aerial applications and 1b mixing liquids for chemigation applications).

All of these scenarios are considered to be short- (1-7 days) and intermediate-term (7 days to several months) duration. In addition, in the absence of chemical-specific use information,10 scenarios identified with an asterisk (*) are also considered to have the potential for long-term exposure (several months to years) (1f, 2f, 4e, 7a, 7b, 7c, 7d, 8a, 8b, and 9b). The list of scenarios assessed are as follows:

(1) Mixing/loading liquids to support:
    (b) aerial applications;
    (c) chemigation applications;
    (d) groundboom applications;
    (d) airblast applications;
    (e) support rights-of-way-sprayer applications; and
    (f) high-pressure hand-wand (livestock areas, greenhouses) applications*.
(2) Mixing/loading wettable powders to support:
    (a) aerial applications;
    (b) chemigation applications;
    (c) groundboom applications;
    (d) airblast applications;
    (e) rights-of-way-sprayer applications;
    (f) high-pressure handwand (livestock areas, greenhouses) applications*, and
    (g) Seed treatment.
(3) Loading granules to support tractor-drawn broadcast spreaders applications.
(4) Applying sprays or liquids with:
    (a) an airblast;
    (b) a groundboom.;
    (c) a paintbrush*;
    (d) an airless sprayer;
    (e) a high-pressure handwand (livestock areas, greenhouses)*;
    (f) a rights-of-way sprayer; and

(g) a fixed-wing aircraft.

(4) Applying granules with a tractor drawn spreader.

(6) Flagging for sprays.

(7) Mixing/loading/applying liquids with:
- (a) a low pressure hand-wand (Pest control operator or PCOs)*;
- (b) a backpack sprayer*;
- (c) a high pressure hand-wand (livestock areas, greenhouse)*, and
- (d) a handgun sprayer used by a lawn care operator (LCO) (lawn)*.

(8) Mixing/loading/applying wettable powders with
- (a) a low pressure hand-wand (PCOs)*, and
- (b) a handgun sprayer used by a LCO (lawn)*.

(9) Loading/applying granules with:
- (a) a belly grinder; and
- (b) a push-type spreader*.

(10) Applying diazinon dust formulations by a PCO.

Use scenarios noted with an asterisk (*) have the potential for long-term exposures. Potential risks from any long-term exposures that may occur under these use scenarios are adequately addressed by the intermediate-term exposure assessment because both risk assessments use the same dermal and inhalation toxicological endpoint.

As noted previously, in July 2000, Novartis stated that they do not plan to support the belly grinder and airless sprayer methods of application, or any indoor use. However, HED included the belly grinder and airless sprayer analyses for completeness, since this the labels have yet to be modified to reflect this change.

Table 3 gives the standard number of acres treated that was used by HED to estimate daily exposure levels in each occupational handler scenario (Exposure Sac Policy number 9, July 5, 2000).

The potential exposures within the 32 identified exposure scenarios are assessed in this RED chapter using the toxicological endpoints and uncertainty factors associated with the active ingredient. Therefore, the PPE and engineering controls are determined by the assessment of the active ingredient and not the currently required PPE/engineering control measures on diazinon labels. This distinction of determining risk mitigation measures based on the active ingredient instead of the label required PPE is important because of the nature of the end-use products. The toxicological endpoint and associated uncertainty factors are often more sensitive than the end-use product's toxicity categories that were used to set the existing label PPE. On the other hand, some end-use products require additional PPE that are not necessary for the active ingredient because of the end-use product's potential for eye and/or skin irritation based on inerts.

A deterministic approach to assessing the potential exposure is presented. The Agency recognizes that the results from a probabilistic analysis would be more appropriate to define the distribution of exposure. However, HED's guidance on probabilistic analyses for nondietary exposures is still draft and the policy is not to regulate the occupational assessments using the probabilistic approach. As per

Agency guidance (U.S.EPA 1992a) *"To conserve resources, most assessments are done in an iterative fashion, with a screening done first; successive iterations add more detail and sophistication. After each iteration, the question is asked, is this level of detail or degree of confidence good enough to achieve the purpose of the assessment? Resource-limited assessments should be evaluated in terms of what part of the original objectives have been accomplished, and how this affects the use of the results."*

In accordance with current HED policy, three increasingly protective measures were assessed (1) baseline protective clothing; (2) additional personal protective equipment (PPE); and (3) use of engineering controls. Risk estimates reflecting baseline attire consists of long pants, long sleeved shirt, and no gloves. Risk estimates reflecting PPE include double layer clothing, chemical-resistent gloves, and 1/2 mask-respirator. There are some PPE, such as chemical-resistant aprons, that the Agency uses as qualitative measures because there are no recognized protection factors (PF) to assess their effectiveness. The Agency's risk managers require these types of PPE as additional mitigation. For example, chemical-resistant aprons are often required to protect mixer/loaders from accidental spills. Risk estimates reflecting engineering controls include closed mixing systems.

3.1.1 Determination of Occupational Handler Exposures

Only one chemical specific applicator study was submitted by the registrant, which is the application of a 2% diazinon dust formulation by a pest control operator (PCO) indoors (Hayes et al. 1980, as summarized in MRID 44348801). In this study, Novartis estimated the PCO absorbed dose of 2.2 µg/kg/day based on the urine biological monitoring for 14 individuals over 3 months. The total amount of diazinon applied was not reported. The peak air concentrations were 41 $\mu g/m^3$, with a geometric mean air concentration of 3.8 $\mu g/m^3$. The inhalation exposure was estimated to be 0.76 µg/kg/day based on the following assumptions and equation: 1.7 m^3/hr*8 hr/day*3.8 $\mu g/m^3$ / 70 kg. The corresponding inhalation MOE is presented on Table 5. Details of the derivation of the Novartis exposure estimates are provided in Study No. 154-97, ABR-97031. and in memo from J. Cruz to B. Chambliss/C. Eiden, March 14, 2000, D229848, D240464, D246141, D261475.

No other chemical-specific occupational mixer/loader/applicator data were available for supporting the reregistration of diazinon. Therefore, recent Occupational and Residential Exposure Task Force (ORETF) data, along with surrogate data from PHED V1.1 were used to assess the potential handler exposures to diazinon. Recent ORETF data (MRID 44972201, based on Dacthal) for a handgun lawn sprayer (scenarios 7b and 8b), and push-type spreader (scenario 9b) were utilized in this assessment. In addition, seed treatment data from a lindane seed treatment study (dust formulation, MRID 44405802) were used for a screening-level assessment of the diazinon seed treatment scenario.

PHED V1.1 was also used to assess agricultural and commercial handlers. PHED was designed by a Task Force of representatives from the U.S. EPA, Health Canada, the California Department of Pesticide Regulation, and member companies of the American Crop Protection Association. PHED is a software system consisting of two parts -- a database of measured exposure values for workers involved in the handling of pesticides under actual field conditions and a set of computer algorithms used

to subset and statistically summarize the selected data. Currently, the database contains values for over 1,700 monitored individuals (i.e., replicates). While data from PHED provide the best available information on handler exposures, it should be noted that some aspects of the included studies (e.g., duration, acres treated, pounds of active ingredient handled) may not accurately represent labeled uses in all cases.

The data in PHED are graded by analytical results only, not study design. The system was designed in this fashion so that the users could select specific criteria to subset the PHED database to reflect the exposure scenario being evaluated (Leighton 1995). The subsetting algorithms in PHED are based on the central assumption that the magnitude of handler exposures to pesticides are primarily a function of activity (e.g., mixing/loading, applying), formulation type (e.g., wettable powders, granulars), application method (e.g., aerial, groundboom), and clothing scenarios (e.g., gloves, double layer clothing). Once the data for a given exposure scenario has been selected, the data are normalized (i.e., divided by) by the amount of pesticide handled resulting in standard unit exposures (milligrams of exposure per pound of active ingredient handled). Following normalization, the data are statistically summarized. The distribution of exposure values for each body part (e.g., chest, upper arm) is categorized as normal, lognormal, or "other" (i.e., neither normal nor lognormal). A central tendency value is then selected from the distribution of the exposure values for each body part. These values are the arithmetic mean for normal distributions, the geometric mean for lognormal distributions, and the median for all "other" distributions. Once selected, the central tendency values for each body part are composited into a "best fit" exposure value representing the entire body.

Data contained in PHED are assigned grades (A through E) based on the overall quality of the analytical recovery data generated concurrently with actual data points (i.e., laboratory recovery, field recovery and stability data). All exposure assessments using PHED were based on the surrogate unit exposure values currently being used as a standard source of exposure values, and the use data presented by the registrant. Values were defined using high quality data and a large number of replicates to calculate exposures if the data were available. However, if not available, rangefinder exposure values were calculated using all data available in PHED.

In general, for PHED data, "Best Available" grades are defined by Exposure Scientific Advisory Council (SAC) SOP for meeting Subdivision U Guidelines. Best available grades are assigned as follows: matrices with grades A and B data and a minimum of 15 replicates; if not available, then grades A, B, and C data and a minimum of 15 replicates; if not available, then all data regardless of the quality and number of replicates. Data confidence are assigned as follows:

High = grades A and B and 15 or more replicates per body part
Medium = grades A, B, and C and 15 or more replicates per body part
Low = grades A, B, C, D, and E or any combination of grades with less than 15 replicates

Tables 4 provides estimates of daily unit dermal and inhalation exposures for three levels of protective equipment for the major exposure and use scenarios. Baseline protection includes a single layer of

clothing including long pants, a long-sleeved shirt, and no gloves. Additional personal protective equipment (PPE) includes wearing coveralls over a single layer of clothing and chemical-resistant gloves. Engineering controls, refers to the use of a single layer of clothing and closed mixing systems and closed-cab tractors. The tables also provide the PHED parameters and caveats specific to each exposure scenario.

Table 5 presents the exposure scenarios, application rates, and area (i.e., acres or gallons) potentially treated that have been used in the exposure calculations. Diazinon labels include a multitude of uses and a wide range of application rates. Therefore, the rates presented in Table 5 are not all inclusive and an attempt has been made to assess the higher application rates to ensure that the exposures are not underestimated if applied up to the labeled maximum rates. However, for some scenarios, a range of application rates were assessed to provide a range of exposure and risk estimates across various occupational uses of diazinon. The detailed dose and risk estimates for the occupational assessment are provided in Appendix A.

Table 3. Occupational Handler Standard (Default) Daily Area(s) Treated per Scenario for Diazinon

Exposure Scenario and Equipment / Usage	Application Rate (lb ai/Acre), unless noted	Daily Acres Treated, unless noted
Mixer/Loader		
Scenario # 1 or 2: Mixing/loading liquids or wettable powders		
a) Aerial	0.5 (foliar cole crops)	350 most crops, 1200 (corn)
	1.25 (foliar corn)	
b) Chemigation	3	35 (cranberries)
c) Groundboom	0.75 foliar	80 and 200 (corn)
	4 (preplant max)	
c) Airblast	1 (hops/grapes)	20 and 40
	2 (fruit trees)	
	3 (nut trees)	
d) Rights-of-Way Sprayer	0.5	40
e) High-pressure Handwand (Livestock Areas)	0.04 lb ai/gal	1000 gal per day
	0.08 lb ai/gal	
(g) Seed treatment	0.094 lb ai/bushel	50 bushels (corn)
Scenario # 3 Loading granules		
Tractor-drawn broadcast spreaders	4 (preplant max)	80 and 200
Applicators		
Scenario # 4 Applying sprays		
a) Airblast	1 (hops/grapes)	20 and 40
	2 (fruit trees)	
	3 (nut trees)	
b) Groundboom	0.75 foliar	80
	4 (preplant max)	
c) Paintbrush (fly control)	0.04 lb ai/gal	5 gal per day
	0.08 lb ai/gal	

Table 3. Occupational Handler Standard (Default) Daily Area(s) Treated per Scenario for Diazinon		
Exposure Scenario and Equipment / Usage	**Application Rate (lb ai/Acre), unless noted**	**Daily Acres Treated, unless noted**
d) Airless Sprayer (fly control)	0.04 lb ai/gal	40 gal per day
	0.08 lb ai/gal	
e) High-pressure Handwand (Livestock Areas)	0.04 lb ai/gal	1000 gal per day
	0.08 lb ai/gal	
f) Rights-of-Way Sprayer	0.5	40
g) Fixed-wing Aircraft	0.5 (foliar cole crops)	350 (most crops) and 1200 (corn)
	1.25 (foliar corn)	
Scenario # 5 Applying granules		
Tractor-drawn broadcast spreaders	4 (preplant max)	80 and 200
Scenario # 6 Flagging (In support of aerial application)		
Sprays	0.5 (foliar cole crops)	350 (most crops) and 1200 (corn)
	1.25 (foliar corn)	
Mixer/Loader/Applicator		
Scenario # 7 Mixing/loading/applying liquids		
a) Low Pressure Handwand	0.04 lb ai/gal	40 gal
	0.08 lb ai/gal	
b) Backpack sprayer	0.04 lb ai/gal	40 gal
c) High pressure handwand (greenhouse)	0.04 lb ai/gal	1000 gal per day
	0.08 lb ai/gal	
d) Handgun (lawn) Sprayer (LCO)	4 (max)	3 and 5
Scenario # 8 Mixing/loading/applying wettable powders		
(a) Low pressure handwand	0.04 lb ai/gal	40 gal per day
(b) Handgun (lawn) Sprayer (LCO)	4 (max)	3 and 5
Scenario # 9 Loading/applying granules		
a) Belly Grinder	3.7 (typical)	1
	4.4 (max)	
b) Push-type spreader	3.7 (typical)	3 and 5
	4.4 (max)	

Table 4. Diazinon Occupational PHED and ORETF Unit Exposures (a)												
Exposure Scenario Equipment / Usage/Source (Baseline PHED)	Level of Protection (b,c,d)	Dermal							Inhalation			
		Unit Exposure (mg/lb ai) (dermal+hands)	Data Confid.	Grades	Repli.	Hand Grade	Hand Repli.	Clothing Scenario (b,c,d)	Unit Exposure (ug/lb ai)	Data Confid.	Grades	Repli.
Mixer/Loader												
Scenario # 1 Mixing/loading liquids												
(a) Aerial (b) Chemigation (c) Groundboom (d) Airblast (e) Rights-of-Way Sprayer (f) High-pressure Handwand (Livestock Areas)	Baseline (b)	2.9	High	AB	72-122	AB	53	LSS, LP, NG	1.2	High	AB	85
	PPE (c)	0.017					59	DLC, CRG	0.12			
	Eng Controls (d)	0.0086			16-22		31	LSS, LP, CRG	0.083			27
Scenario # 2 Mixing/loading wettable powders												
(a) Aerial (b) Chemigation (c) Groundboom (d) Airblast (e) Rights-of-Way Sprayer (f) High-pressure Hand-wand (Livestock Areas)	Baseline	3.7	Low	ABC	22-45	ABC	7	LSS, LP, NG	43	Medium	ABC	44
	PPE	0.13	Medium				24	DLC, CRG	4.3			
	Eng Controls	0.021	Low	AB	6-15	AB	5	LSS, LP, NG	0.24	Low	All	15
(g) Seed Treatment (based on Lindane dust formulation) MRID 44405802	Baseline	No Data										
	PPE	9.4 (A.M)	Medium	AB	12	AB	12	single layer, LSS, LP, CRG	1.6	Medium	AB	12
	Eng Controls	Not Feasible										
Scenario # 3 Loading granules												
Tractor-drawn broadcast spreaders	Baseline	0.0084	Low	ABC	33-78	All	10	LSS, LP, NG	1.7	High	AB	58
	PPE	0.0034			12-59	AB	24	DLC, CRG	0.17			
	Eng Controls	0.00017			33-78	All	10	LSS, LP, NG	0.034			
Applicator												
Scenario # 4 Applying sprays / liquids												
a) Airblast	Baseline	0.36	High	AB	32-49	AB	22	LSS,LP,NG	4.5	High	AB	47
	PPE	0.22			31-48		18	DLC, CRG	0.45			

Table 4. Diazinon Occupational PHED and ORETF Unit Exposures (a)												
Exposure Scenario Equipment / Usage/Source PHED)	Level of Protection (b,c,d)	Dermal							Inhalation			
		Unit Exposure (mg/lb ai) (dermal+hands)	Data Confid.	Grades	Repli.	Hand Grade	Hand Repli.	Clothing Scenario (b,c,d)	Unit Exposure (ug/lb ai)	Data Confid.	Grades	Repli.
	Eng Controls	0.019			20-30		20	LSS, LP, ORG	0.45	Low	ABC	9

Table 4. Diazinon Occupational PHED and ORETF Unit Exposures (a)

Exposure Scenario Equipment / Usage/Source (PHED)	Level of Protection (b,c,d)	Dermal							Inhalation			
		Unit Exposure (mg/lb ai) (dermal+hands)	Data Confid.	Grades	Repli.	Hand Grade	Hand Repli.	Clothing Scenario (b,c,d)	Unit Exposure (ug/lb ai)	Data Confid.	Grades	Repli.
b) Groundboom	Baseline	0.014	High	AB	23-42	AB	29	LSS,LP,NG	0.74	High	AB	22
	PPE	0.01	Medium			ABC	21	DLC, CRG	0.074			
	Eng Controls	0.005		ABC	20-31		16	LSS, LP, NG	0.043			16
c) Paintbrush	Baseline	180	Low	C	14-15	B	15	LSS,LP,NG	280	Medium	C	15
	PPE	22				AB		DLC, CRG	28			
	Eng Controls	Not Feasible										
d) Airless Sprayer	Baseline	38	High	B	15	B	15	LSS,LP,NG	830	Medium	C	15
	PPE	14						DLC, CRG	83			
	Eng Controls	Not Feasible										
e) High-pressure Handwand (Livestock Areas)	Baseline	1.8	Low	All	9-11	All	2	LSS,LP,NG	79	Low	All	11
	PPE	0.36					9	DLC, CRG, R	7.9			
	Eng Controls	Not Feasible										
f) Rights-of-Way Sprayer	Baseline	1.3	Low	ABC	4-20	AB	16	LSS,LP,NG	3.9	High	A	16
	PPE	0.29					4	DLC, CRG, R	0.39			
	Eng Controls	Not Feasible										
g) Fixed-wing Aircraft	Baseline	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
	PPE											
	Eng Controls	0.005	Medium	ABC	24-48	AB	34	LSS, LP, NG	0.068	Medium	ABC	23
Scenario # 5 Applying granules												
Tractor-drawn broadcast spreaders	Baseline	0.0099	Low	AB	1-5	AB	5	LSS,LP,NG	1.2	Low	AB	5
	PPE	0.0042						DLC, CRG, R	0.12			
	Eng Controls	0.0021	High		27-30		24	LSS, LP, NG	0.22	High		37
Scenario # 6 Flagging (In support of aerial application)												
Sprays	Baseline	0.011	High	AB	18-28	AB	30	LSS,LP,NG	0.35	High	AB	28
	PPE	0.01						DLC, CRG, R	0.035			
	Eng Controls	0.00022						LSS, LP, NG	0.007			

Table 4. Diazinon Occupational PHED and ORETF Unit Exposures (a)

Exposure Scenario Equipment / Usage/Source PHED)	Level of Protection (b,c,d)	Dermal							Inhalation			
		Unit Exposure (mg/lb ai) (dermal+hands)	Data Confid.	Grades	Repli.	Hand Grade	Hand Repli.	Clothing Scenario (b,c,d)	Unit Exposure (ug/lb ai)	Data Confid.	Grades	Repli.
Mixer/Loader/Applicator												
Scenario # 7 Mixing/loading/applying liquids												
a) Low Pressure Hand-wand	Baseline	100	Low	ABC	9-80	All	70	LSS, LP, NG	30	Medium	ABC	80
	PPE	0.37				ABC	10	DLC, CRG, R	3			
	Eng Controls	Not Feasible										
b) Backpack sprayer	Baseline	No data	Low	AB	9-11	C	11	LSS, LP, NG	30	Low	A	11
	PPE	1.6						DLC, CRG, R	3			
	Eng Controls	Not Feasible										
c) High pressure hand-wand (greenhouse)	Baseline	3.5	Low	AB	7-13	C	13	LSS, LP, NG	120	Low	A	13
	PPE	1.6						DLC, CRG, R	12			
	Eng Controls	Not Feasible										
d) Handgun (Lance) Sprayer (ORETF Dacthal study, MRID 44972201)	Baseline	0.69 (G.M)						LSS, LP, NG	1.5 (G.M)			
	PPE	0.25 (G.M.)						DLC, CRG, R	0.15			
	Eng Controls	Not Feasible										
Scenario # 8 Mixing/loading/applying wettable powders												
(a) Low pressure hand-wand	Baseline	8.6	Medium	ABC	16	AB	15	LSS, LP, NG	1100	Medium	ABC	16
	PPE	6.2						DLC, CRG, R	110			
	Eng Controls	Not Feasible										
(b) Handgun (Lance) sprayer (ORETF Dacthal study, MRID 44972201, EPA Reg No. 100-460)	Baseline	1 (G.M)						LSS, LP, NG	62			
	PPE	0.39 (G.M)						DLC, CRG, R	6.2			
	Eng Controls	Not Feasible										
Scenario # 9 Loading/applying granules												
a) Belly Grinder	Baseline	10	Medium	ABC	29-45	ABC	23	LSS, LP, NG	62	High	AB	40
	PPE	5.7	Low			All	20	DLC, CRG, R	6.2			
	Eng Controls	Not Feasible										
b) Push-type spreader (OREFT Dacthal, MRID44972201)	Baseline	0.31	Low	C	0-15	C	15	LSS, LP, NG	7.1	High	B	15
	PPE	0.24						Single layer clothes, CRG, R	0.71			
	Eng Controls	Not Feasible										

NF = Not Feasible; ND = No Data; A.M=arithmetic mean; G.M.=geometric mean

(a) The Pesticide Handler Exposure Database (PHED) Version 1.1
(b) Baseline Dermal Unit Exposure is based on workers wearing long sleeve shirts and long par
open mixing/loading; and open cab tractor; except for backpack sprayers. Chemical resistant g
scenario is not available. Baseline data are not available for aerial application. Baseline i
(C) Additional Personal Protective Equipment (PPE) to reduce dermal exposures = workers wear
[Double Layer Clothing with Chemical Resistant Gloves (DLC, CRG)]. PPE data are not available
respirator (R) = dust/mist respirator applied to the baseline unit exposure[(Decreases the bas
worker has achieved a protective seal. This is accomplished by the worker being medically qual
seal was achieved, and he/she has had the appropriate training to maintain the respirator in g
Institute (ANSI) and or OSHA 29CFR 1910.134).
(d) Engineering Controls = single layer clothing and no gloves - LSS, LP, NG (except where not
available) and closed mixing systems and enclosed cab tractors. Engineering Control inhalatic

3.1.2 Summary of Uncertainties

The handler exposure assessments encompass all of the major uses of diazinon throughout the country. The assessment provides the estimated exposures for the maximum labeled rates. In addition to providing exposure estimates for those individuals who use the maximum rates stipulated on the labels, the Agency also includes other rates such as the lower rates for foliar applications to assist the regulatory risk managers in their decisions. HED believes this assessment is realistic and yet provides a reasonable certainty that the exposures are not underestimated. The assumptions and uncertainties identified below are included for characterization and transparency:

- *Application Rates:* Each exposure scenario includes the label maximum application rate. In addition, a range of application rates was used when the maximum application rates for various crops varied widely. Other than a national survey, there are no statistical techniques to determine what rates to include in an assessment -- other than always including the maximum rates. In most instances, the maximum labeled application rates were used with application techniques that are feasible, given the amount of dilute spray that needs to be applied.

- *Amount Handled:* The daily acres treated are HED standard values (see Table 3) along with the amount of gallons that may be applied using handheld equipment. In this deterministic approach, central tendency values for unit exposures from PHED are mixed with high end input parameters such as the application rate and acres treated.

- *Unit Exposures:* The unit exposure values calculated by PHED generally range from the geometric mean to the median of the selected data set. To add consistency and quality control to the values produced from this system, the PHED Task Force has evaluated all data within the system and has developed a set of grading criteria to characterize the quality of the original study data. The assessment of data quality is based on the number of observations and the available quality control data. These evaluation criteria and the caveats specific to each exposure scenario are summarized in the PHED Surrogate Exposure Guide dated August 1998. While data from PHED provides the best available information on handler exposures, it should be noted that some aspects of the included studies (e.g., duration, acres treated, pounds of active ingredient handled) may not accurately represent labeled uses in all cases.

- *Exposure Factors:* The ratio of the body surface area used in dermal calculations to the body weight to estimate potential dose overestimates by a factor of 1.1. The ratio is not physiologically matched in that the surface area is for an average male while the body weight is the median for both male/female. The reduction factor would increase a dermal MOE from 8 to 9 or 90 to 100. HED has agreed to use the NAFTA recommended values for breathing rate rather than the existing rate in Series 875 Group A (i.e., previously known as Subdivision U). Series 875 Group A recommends an inhalation rate of 29 L/min. The new NAFTA recommended inhalation rates are 8.3, 16.7, and 26.7 L/min for sedentary activities (e.g., driving a tractor), light activities (e.g., flaggers and mixer/loaders < 50 lb containers), and moderate activities (e.g., loading > 50 lb

containers, handheld equipment in hilly conditions), respectively. These inhalation reduction factors are 3.5 for tractor drivers, 1.7 for mixer/loaders and flaggers, and 1.1 for handheld equipment. These changes in exposure factors will be programmed in PHED V2.0 and are characterized in this document for regulatory risk management decisions.

3.1.3 Calculations of Exposure

The algorithms to calculate the inhalation and dermal unit exposures from passive dosimetry studies are numerous and the readers are referred to Series 875 Group A (formerly the U.S. EPA Pesticide Assessment Guidelines, Subdivision U: Applicator Exposure) and the PHED Reference Manual (U.S.EPA et al. 1995b) for specific algorithms and body surface areas. HED's current RED format does not include sample calculations for the unit exposures (e.g., mg/lb ai), but examples can be found in the PHED Reference Manual. However, potential daily dermal exposure (e.g., mg/day) is calculated using the formula below. The short-term exposures do not incorporate the dermal absorption estimate because the endpoint is derived from a 21-day dermal rabbit study. No correction factors are used for relative differences in rabbit versus human skin permeability or differences in metabolism.

$$\text{Daily Dermal Exposure}\left(\frac{\text{mg AI}}{\text{kg-Day}}\right) = \text{Dermal Unit Exposure}\left(\frac{\text{mg AI}}{\text{lb AI}}\right) \cdot \text{Max. Appl. Rate}\left(\frac{\text{lb AI}}{\text{Acre}}\right) \cdot \text{Max. Area Treated}\left(\frac{\text{Acres}}{\text{Day}}\right) \div \text{Body weight}$$

Potential daily inhalation exposure is calculated using the following formula:

$$\text{Daily Inhal. Exposure}\left(\frac{\text{mg AI}}{\text{kg-Day}}\right) = \text{Inhal. Unit Exposure}\left(\frac{\text{mg AI}}{\text{lb AI}}\right) \cdot \text{Max. Appl. Rate}\left(\frac{\text{lb AI}}{\text{Acre}}\right) \cdot \text{Max. Area Treated}\left(\frac{\text{Acres}}{\text{Day}}\right) \div \text{Body Weight}$$

These calculations of potential daily exposure to diazinon by handlers are used to calculate the administered doses (non absorbed) and total risk estimates to those handlers. A body weight of 70 kg was used to estimate dermal and inhalation doses.

3.2 Occupational Handler Risk Characterization

3.2.1 Dermal and Inhalation Margins of Exposure (MOEs)

The occupational handler risks are characterized using a hazard evaluation approach. The short-, intermediate- and long-term margin of exposures (MOEs) were calculated using the following formulas:

Dermal MOE = Dermal NOAEL (mg/kg/day)/ Dermal Daily Dose (mg/kg/day)

Inhalation MOE = Inhalation LOAEL (mg/kg/day)/ Inhalation Daily Dose (mg/kg/day)

The MOE is the ratio of the dose that was shown to cause a no-observed adverse effect level (NOAEL) or a lowest observed adverse effect level (LOAEL) in the case of inhalation, in the animal to the

anticipated handler exposure. A ratio, or MOE, of 100 signifies that the dose level in the animal that cause no effects is 100 times the dose level estimated for the handler. A target MOE of 100 is used to account for 10x variability between animals and humans and another 10x to account for variability among humans. As noted previously, some target MOEs are 300 (see below). Appendix A presents the MOE calculations for personal protective equipment (PPE) and engineering controls.

As shown on Table 5, HED estimated risks for 32 occupational handler exposure scenarios. The target MOE is 100 for short-term dermal exposures and is 300 for intermediate- and long-term dermal and all inhalation exposure durations. As noted previously, the risk estimates are based on general assumptions about application rate, and acres treated shown on Table 3, in addition to the dermal and inhalation unit exposures provided in Table 4. Three increasingly protective measures were assessed (1) baseline protective clothing; (2) additional personal protective equipment (PPE); and (3) use of engineering controls.

For baseline exposures all of the dermal MOEs were less than 100 (MOEs range from 0.013 to 83) and all of the inhalation MOEs were less than 300 (MOEs range from 0.03 to 240) and therefore, exceed HED's level of concern regardless of exposure duration (see Table 5).

For exposure estimates with PPE:

All short-term dermal exposures had MOEs less than 100 (MOEs range from 0.36 to 69) except the following scenarios:

(1d) mixing/loading liquids for an airblast application at 1 lb ai/A for hops and grapes at 20 and 40 acres and 2 lb ai/A for trees at 20 acres;
(1e) mixing/loading liquids for a rights of way sprayer at 0.5 lb ai/A for 40 acres;
(1f) mixing/loading liquids for a high pressure handwand (livestock areas, greenhouses) at 0.04 lb ai/gal for 1000 gal/day;
(4b) applying sprays/liquids using a groundboom tractor (0.75 lb ai/A for 80 acres); and
(7a) mixing/loading/applying liquids using a low pressure handwand (livestock areas, PCOs) at 0.04 lb ai/gal for 40 gal/day.

All intermediate- and long-term dermal exposures had MOEs less than 300 (MOEs range from 0.36 to 210).

All inhalation exposures had MOEs less than 300 (MOEs range from 0.28 to 250), except the following scenarios:

(1d) mixing/loading liquids for an airblast application at 1 lb ai/A for hops and grapes at 20 and 40 acres and 2 lb ai/A for fruit trees at 20 acres;
(1e) mixing/loading liquids for a rights of way sprayer at 0.5 lb ai/A for 40 acres;

(1f) mixing loading liquids for high pressure handwand (livestock areas, greenhouses) at 0.04 lb ai/gal for 1000 gal/day;
(2g) mixing/loading wettable powders for seed treatment at 0.094 lb ai/A for 50 bushels (corn);
(4b) applying sprays/liquids with a groundboom tractor at 0.75 lb ai/A for 80 acres;
(4c) applying liquids with a paintbrush for fly control at 0.04 lb ai/gal for 5 gal;
(6) Flagging for spray applications at 0.5 lb ai/A for 350 acres;
(7a) mixing/loading/applying liquids with a low pressure handwand at 0.04 lb ai/gal for 40 gal;
(7b) mixing/loading/applying liquids with a backpack sprayer at 0.04 lb ai/gal for 40 gal; and
(7d) mixing/loading/applying liquids with a handgun sprayer (lawn care operator) at 4 lb ai/A for 3 or 5 acres.

With the implementation of engineering controls [closed mixing system or enclosed cabs]:

All of the scenarios had MOEs less than 100 for short-term dermal and 300 for inhalation, except the following scenarios:

(1c) mixing/loading liquids for a groundboom application at 0.75 lb ai/A foliar;
(1d) mixing/loading liquids for an airblast application at up to 3 lb ai/A
(1e) mixing/loading liquids for a rights of way sprayer at 0.5 lb ai/A for 40 acres;
(1f) mixing/loading liquids for a high pressure handwand (livestock areas, greenhouse) at 0.04 lb ai/gal for dermal and inhalation and 0.08 lb ai/gal for dermal;
(2d) mixing/loading wettable powders for an airblast application at 1 lb ai/acre for 20 acres;
(2e) mixing/loading wettable powders for a rights of way sprayer at 0.5 lb ai/A for 40 acres;
(3) Loading granules onto a tractor-drawn broadcast spreader at 4 lb ai/A for 80 and 200 acres for dermal only;
(4a) applying sprays/liquids with an airblast at 1 lb ai/acre for 20 acres for dermal only;
(4b) applying sprays/liquids with a groundboom at a foliar rate of 0.75 lb ai/A for 80 acres;
(5) Applying granules with a tractor-drawn broadcast spreader at 4 lb ai/A for 80 acres for dermal only; and
(6) Flagger exposures for spray applications at rates up to 4 lb ai/A for 350 acres for dermal only and up to 1.25 lb ai/A for 350 acres for inhalation.

For intermediate- and long-term dermal and inhalation exposures, all scenarios had MOEs less than 300, except the following:

(1c) mixing/loading liquids for groundboom at 0.75 lb ai/A for 80 acres for inhalation only;

(1d) mixing/loading liquids for an airblast application at 1 lb ai/A for hops and grapes for dermal and up to 3 lb ai/A for inhalation;
(1e) mixing/loading liquids for a rights of way sprayer for liquids at 0.5 lb ai/A for 40 acres;
(1f) mixing/loading liquids for high pressure handwand (inhalation only);
(2d) mixing/loading wettable powders for airblast application (inhalation only);
(2e) mixing/loading liquids for a rights of way sprayer for liquids at 0.5 lb ai/A for 40 acres (inhalation only);
(3) Loading granules onto a tractor-drawn broadcast spreader at 4 lb ai/A for 80 and 200 acres (dermal only);
(4b) applying sprays/liquids using groundboom up to 0.75 lb ai/A (inhalation only); and
(6) Flagger exposures for spray applications at rates up to 1.25 lb ai/A for 350 acres.

3.2.2 Aggregate Risk Indices and Total Dermal and Inhalation MOEs

Because the same toxicity endpoint (i.e., cholinesterase inhibition) is applicable to both inhalation and dermal risk assessments, and because dermal and inhalation exposures may occur simultaneously, it is appropriate to add these exposures together to obtain a total risk estimate for occupational exposure. As seen above, at various label application use rates, several dermal and inhalation exposure scenarios have MOEs that are greater than the appropriate target MOE (i.e., $ 100 for short-term dermal or and $ 300 for longer-term dermal and inhalation).

Short-Term Aggregate Risk Indices

The formula used to combine the short-term dermal and inhalation risks is the Aggregate Risk Index, because the dermal and inhalation exposures have different target MOEs (i.e,. target MOE $100 for dermal and $300 for inhalation):

For combined short-term dermal and inhalation exposure risk estimates:

$ARI = MOE_{calculated} / MOE_{acceptable}$
$ARI_{dermal} = MOE_{calculated\ dermal} / MOE_{acceptable\ dermal}$
$ARI_{inhalation} = MOE_{calculated\ inhalation} / MOE_{acceptable\ inhalation}$

$$Aggregate Risk Index (ARI) = \frac{1}{\frac{1}{ARI_{dermal}} + \frac{1}{ARI_{inhalation}}}$$

The combined short-term dermal and inhalation ARIs are shown on Table 5 for all scenarios. The target ARI is $1, where ARIs $ 1 do not exceed HED's level of concern.

As shown on Table 5, with PPE and/or engineering controls only 5 exposure scenarios have ARIs $ 1 and therefore, do not exceed HED's level of concern for combined short-term dermal and inhalation exposure. These scenarios are as follows:

(1d) mixing/loading liquids for airblast application at 1 lb ai/A for 20 acres (ARI=1.13-1.9);
(1e) mixing/loading liquids for right-of-way sprayer at 0.5 lb ai/A for 40 acres (ARI=1.13-1.9);
(4b) applying liquids with a groundboom tractor at 0.75 foliar rate for 80 acres with engineering controls (ARI=1.2); and
(6) flagging for spray applications at 0.5 and 1.25 lb ai/A for 350 acres (ARI=1.6-3.9).

Intermediate and Long-Term Aggregate MOEs

Intermediate- and long-term aggregate MOEs are calculated because the target MOE is 300 for both dermal and inhalation exposures. Therefore, aggregate MOEs $300 do not exceed HED's level of concern. The following reciprocal MOE calculation is used to aggregate dermal and inhalation risks:

Total MOE = 1 / [(1/Dermal MOE) + (1/Inhalation MOE)]

As shown on Table 5, with PPE and/or engineering controls only 4 exposure scenarios have MOEs $ 300 and therefore, do not exceed HED's level of concern for combined intermediate-term dermal and inhalation exposure. These scenarios are as follows:

(1d) mixing/loading liquids for airblast application at 1 lb ai/A for 20 acres (total MOE=300);
(1e) mixing/loading liquids for right-of-way sprayer at 0.5 lb ai/A for 40 acres (total MOE=300); and
(6) flagging for spray applications at 0.5 and 1.25 lb ai/A for 350 acres (total MOE=330-820).

Table 5
Exposure Variables and Risk Estimates for
Agricultural and Commercial Handler Uses of Diazinon
Short-, Intermediate- and Long-Term (as applicable) Durations

Exposure Scenario (Scenario#(a) (g)	Application Rates (lbs ai/acre) (unless noted)	Daily Acres Treated (b)	Baseline MOEs (c,d)		PPE MOEs (c,e)				Engineering Controls MOEs (c,f)			
			Dermal	Inhalation	Dermal	Inhalation	Total ARI (short-term) Target 1	Total MOE (Intermediate and Long Term) Target 300	Dermal	Inhalation	Total ARI (short-term) Target 1	Total MOE (Intermediate and Long Term) Target 300
Mixer/Loader Exposure												
Scenario #1 -Mixing/Loading Liquids												
Aerial Application (1a)	0.5 (foliar cole crops)	350	0.14	8.7	24	87	0.13	19	47	130	0.22	34
	1.25 (foliar corn)	350	0.06	3.5	9.4	35	0.05	7.4	19	50	0.09	14
		1200	0.016	1	2.7	10	0.02	2.2	5.4	15	0.03	4
Chemigation (1b)	1 (max) (orchards)	35	0.23	15	39	150	0.21	31	77	210	0.37	56
Groundboom Application (1c)	0.75 (foliar)	80	0.4	25	69	250	0.38	54	140	370	0.64	100
		200	0.16	10	28	100	0.15	22	54	150	0.26	40
	4 (preplant, max)	80	0.075	4.7	13	47	0.07	10	25	69	0.12	19
		200	0.03	1.9	5.1	19	0.03	4	10	27	0.05	7.4
Airblast Application (1d)	1 (orchards) (k)	20	1.2	76	200	760	1.13	160	400	1100	1.93	300
		40	0.6	38	100	380	0.57	81	200	550	0.96	150
	2 (fruit trees) (k)	20	0.6	38	100	380	0.57	81	200	550	0.96	150
		40	0.3	19	52	190	0.28	40	100	270	0.48	74
	3 (nut trees) (j,k)	20	0.4	25	69	250	0.38	54	140	370	0.64	100
Rights-of-Way Sprayer (1e)	0.5	40	1.2	76	210	760	1.13	160	400	1100	1.9	300

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Agricultural and Commercial Handler Uses of Diazinon
Short-, Intermediate- and Long-Term (as applicable) Durations

Exposure Scenario (Scenario#) (g)	Application Rates (lbs ai/acre) (unless noted)	Daily Acres Treated (b)	Baseline MOEs (c,d)		PPE MOEs (c,e)				Engineering Controls MOEs (c,f)			
			Dermal	Inhalation	Dermal	Inhalation	Total ARI (short-term) Target 1	Total MOE (Intermediate and Long Term) Target 300	Dermal	Inhalation	Total ARI (short-term) Target 1	Total MOE (Intermediate and Long Term) Target 300
High-pressure Handwand (h) (Livestock Areas, greenhouses) (1f) *	0.94 lb ai/gal (h)	1000 gal/day	0.6	38	100	380	0.57	81	200	550	0.96	150
	0.48 lb ai/gal (h)		0.3	19	52	190	0.28	40	100	270	0.48	74
Scenario #2 -Mixing/Loading Wettable Powders												
Aerial Application (2a)	0.5 (forage crops)	350	0.11	0.24	3.1	2.4	0.01	1.3	19	43	0.08	13
	1.25 (forage crops)	350	0.043	0.1	1.2	0.97	0.003	0.5	7.6	17	0.03	5.3
		1200	0.013	0.03	0.36	0.28	0.001	0.16	2.2	5.1	0.01	1.5
Chemigation (2b)	1 (orchards)	35	0.19	0.4	5.2	4	0.01	2.3	32	72	0.13	23
Groundboom Foliar Application (2c)	0.75	80	0.32	0.71	9	7	0.019	4	56	130	0.24	39
		200	0.13	0.28	3.6	2.8	0.007	1.6	22	51	0.1	15
	4 (pre-plant, max)	80	0.06	0.13	1.7	1.3	0.003	0.74	10	24	0.04	7
		200	0.024	0.05	0.68	0.53	0.001	0.3	4.2	9.5	0.02	3
Airblast Application (2d)	1 (orchards) (k)	20	0.94	2.2	26	21	0.06	12	170	380	0.72	120
		40	0.47	1.1	13	11	0.03	6	83	190	0.36	60
	2 (fruit trees) (k)	20	0.48	1.1	13	11	0.03	6	83	190	0.36	60
		40	0.24	0.53	6.7	5.3	0.01	3	42	95	0.18	29
	3 (nut trees) (j,k)	20	0.32	0.71	9	7	0.02	4	56	130	0.24	39

Table 5
Exposure Variables and Risk Estimates for
Agricultural and Commercial Handler Uses of Diazinon
Short-, Intermediate- and Long-Term (as applicable) Durations

Exposure Scenario (Scenario#(a) (g)	Application Rates (lbs ai/acre) (unless noted)	Daily Acres Treated (b)	Baseline MOEs (c,d)		PPE MOEs (c,e)				Engineering Controls MOEs (c,f)			
			Dermal	Inhalation	Dermal	Inhalation	Total ARI (short-term) Target 1	Total MOE (Intermediate and Long Term) Target 300	Dermal	Inhalation	Total ARI (short-term) Target 1	Total MOE (Intermediate and Long Term) Target 300
Rights-of-Way Sprayer (2e)	0.5	40	0.95	2.1	27	21	0.06	12	170	380	0.72	120
High-pressure Handwand (h) (Livestock Areas, greenhouses) (2f) *	0.94 lb ai/gal	1000 gal/day	0.47	1.1	13	11	0.03	5.9	83	190	0.36	58
	0.81 lb ai/gal (h)		0.24	0.53	6.7	5.3	0.01	3	42	95	0.18	29
Seed Treatment (2g) (l)	0.094 lb ai/bushel	50 bushels (corn)	ND	240	1.6	2400	0.02	1.6	Not Feasible			

Table 5
Exposure Variables and Risk Estimates for
Agricultural and Commercial Handler Uses of Diazinon
Short-, Intermediate- and Long-Term (as applicable) Durations

Exposure Scenario (Scenario#(a) (g)	Application Rates (lbai/acre) (unless noted)	Daily Acres Treated (b)	Baseline MOEs (c,d)		PPE MOEs (c,e)				Engineering Controls MOEs (c,f)			
			Dermal	Inhalation	Dermal	Inhalation	Total ARI (short-term) Target 1	Total MOE (Intermediate and Long Term) Target 300	Dermal	Inhalation	Total ARI (short-term) Target 1	Total MOE (Intermediate and Long Term) Target 300
Applicator Exposure												
Scenario #3 - Loading Granules												
Tractor-drawn broadcast spreaders (3)	4 (preplant, max)	80	26	3.4	64	34	0.1	22	1300	170	0.53	150
		200	10	1.	26	13	0.04	8.8	510	67	0.21	60
Scenario #4 -Applying sprays/liquids												
Airblast (h)	1 (tree nuts) (k)	20	9.8	20	16	200	0.13	15	180	200	0.49	96
		40	4.9	10	8	100	0.06	7.4	92	100	0.25	48
	2 (fruit trees) (k)	20	5	10	8	100	0.06	7.4	92	100	0.25	48
		40	2.4	5	4	50	0.03	3.7	46	51	0.12	24
	3 (nut trees) (j,k)	20	3.2	6.7	5.3	67	0.04	4.9	61	67	0.16	32
Groundboom Tractor	0.75 foliar (4b)	80	83	41	120	410	0.63	91	230	700	1.2	180
		200	33	16	47	160	0.25	36	93	280	0.47	70
	4 (preplant, max)	80	16	7.7	22	77	0.12	17	44	130	0.22	33
		200	6.3	3.1	8.8	31	0.05	7	18	53	0.09	13

Table 5
Exposure Variables and Risk Estimates for
Agricultural and Commercial Handler Uses of Diazinon
Short-, Intermediate- and Long-Term (as applicable) Durations

Exposure Scenario (Scenario#(a) (g)	Application Rates (lbai/acre) (unless noted)	Daily Acres Treated (b)	Baseline MOEs (c,d)		PPE MOEs (c,e)				Engineering Controls MOEs (c,f)			
			Dermal	Inhalation	Dermal	Inhalation	Total ARI (short-term) Target 1	Total MOE (Intermediate and Long Term) Target 300	Dermal	Inhalation	Total ARI (short-term) Target 1	Total MOE (Intermediate and Long Term) Target 300
Paintbrush (4c) (fly control)	0.01 lbai/gal (i)	5 gal/day	1.9	33	16	330	0.14	15	Not Feasible			
	0.08 lbai/gal (i)		0.97	16	8	160	0.07	7.6				
Airless Sprayer (4d) (fly control)	0.01 lbai/gal (i)	40 gal/day	1.2	1.4	3.1	14	0.02	2.5	Not Feasible			
	0.08 lbai/gal (i)		0.58	0.69	1.6	6.9	0.01	1.3				
High-pressure Handwand (h) (Livestock Areas, greenhouses) (4e)*	0.01 lbai/gal (h)	1000 gal/day	0.97	0.58	4.9	5.8	0.01	2.6	Not Feasible			
	0.08 lbai/gal (h)		0.49	0.29	2.5	2.9	0.01	1.3				
Rights-of-Way Sprayer (4f)	0.5	40	2.7	23	12	230	0.1	11	Not Feasible			
Fixed-wing Aircraft – Enclosed Cockpit (4g)	0.5 (for corn crops)	350	No Open cockpit data available						80	150	0.31	53
	1.25 (for corn)	350							32	61	0.12	21
		1200							9	18	0.04	6.1

Table 5
Exposure Variables and Risk Estimates for
Agricultural and Commercial Handler Uses of Diazinon
Short-, Intermediate- and Long-Term (as applicable) Durations

Exposure Scenario (Scenario #(a) (g)	Application Rates (lbs ai/acre) (unless noted)	Daily Acres Treated (b)	Baseline MOEs (c,d)		PPE MOEs (c,e)				Engineering Controls MOEs (c,f)			
			Dermal	Inhalation	Dermal	Inhalation	Total ARI (short-term) Target 1	Total MOE (Intermediate and Long Term) Target 300	Dermal	Inhalation	Total ARI (short-term) Target 1	Total MOE (Intermediate and Long Term) Target 300
Scenario #5 -Applying granules												
Tractor-Drawn Granular Spreader (5)	4 (max)	80	22	4.7	52	47	0.12	25	100	26	0.08	21
		200	8.8	1.9	21	19	0.05	9.9	42	10	0.03	8
Flagger Exposure												
Scenario #6 -Flagging												
Spray Applications (6)	0.5 (for citrus)	350	36	30	40	300	0.28	35	1800	1500	3.9	820
	1.25 (for corn)	350	15	12	16	120	0.11	14	730	590	1.6	330
		1200	4.2	3.5	4.7	35	0.03	4	210	170	0.45	95
Mixer/Loader/Applicator Exposure												
Scenario #7 -Mixing/loading/applying liquids												
Low Pressure Handwand (h) (Pest Control Operators, PCOs, livestock areas) (7a)*	0.06 lb ai/gal	40 gal	0.44	38	120	380	0.61	90	Not Feasible			
	0.01 lb ai/gal		0.22	19	59	190	0.31	45				
Backpack Sprayer (livestock, PCOs) (7b)*	0.04 lb ai/gal	40 gal	ND	38	27	380	0.22	26	Not Feasible			

Table 5
Exposure Variables and Risk Estimates for
Agricultural and Commercial Handler Uses of Diazinon
Short-, Intermediate- and Long-Term (as applicable) Durations

Exposure Scenario (Scenario#) (g)	Application Rates (lbs ai/acre) (unless noted)	Daily Acres Treated (b)	Baseline MOEs (c,d)		PPE MOEs (c,e)				Engineering Controls MOEs (c,f)			
			Dermal	Inhalation	Dermal	Inhalation	Total ARI (short-term) Target 1	Total MOE (Intermediate and Long Term) Target 300	Dermal	Inhalation	Total ARI (short-term) Target 1	Total MOE (Intermediate and Long Term) Target 300
High Pressure Handwand (total) (h) (livestock areas, greenhouse uses) (7a)	0.84 lb ai/gal	1000 gal/day	0.5	0.38	1.1	3.8	0.01	0.85	Not Feasible			
	0.38 lb ai/gal (h)		0.25	0.19	0.5	1.9	0.003	0.42				
Handgun Sprayer (Lawn Care Operator, LCO) (7d)*	4	3	8.3	100	23	1000	0.22	23	Not Feasible			
		5	5	61	14	610	0.13	14				
Scenario #8 -Mixing/loading/applying Wettable Powders												
Low Pressure Handwand (min) (8a) (PCOs)*	0.84 lb ai/gal	40 gal	5.1	1	7.1	10.3	0.02	4.2	Not Feasible			
Handgun Sprayer (Lawn Care Operators) (8b)*	4	3	5.8	2.5	15	25	0.05	9.5	Not Feasible			
		5	3.5	1.5	9.2	15	0.03	5.7				

Table 5
Exposure Variables and Risk Estimates for
Agricultural and Commercial Handler Uses of Diazinon
Short-, Intermediate- and Long-Term (as applicable) Durations

Exposure Scenario (Scenario#(a) (g)	Application Rates (lb ai/acre) (unless noted)	Daily Acres Treated (b)	Baseline MOEs (c,d)		PPE MOEs (c,e)				Engineering Controls MOEs (c,f)			
			Dermal	Inhalation	Dermal	Inhalation	Total ARI (short-term) Target 1	Total MOE (Intermediate and Long Term) Target 300	Dermal	Inhalation	Total ARI (short-term) Target 1	Total MOE (Intermediate and Long Term) Target 300
Scenario #9 - Loading/applying Granules												
Belly Grinder (9a)	3.7 (typical)	1	1.9	8	3.3	80	0.03	3.2	Not feasible			
	4.4 (max)		1.6	6.7	2.8	67	0.02	2.7				
Push-type spreader (9b) (LCOs)*	3.7 (typical)	3	20	24	25	230	0.2	24	Not Feasible			
	4.4 (max)		17	20	22	200	0.16	20				
	3.7 (typical)	5	12	14	16	140	0.12	14				
	4.4 (max)		10	12	13	120	0.1	12				
Scenario #10 - Applying Dust Formulation												
Dust Application (PCO) (MRID 44348801)	2% formulation	total amount unknown	not estimated	35	No Data				Not Feasible			

(a) Application rates are a range of representative and maximum rates values found in the dia
(1) Wettable powders - EPA Reg. No. 100-460 (Diazinon 50 W) for crops and right-of-way (i
(2) Liquid formulations - EPA Reg. Nos. 100-784 (AG600 WBC) and 100-461 (AG500 emulsifiab
on the EPA Reg. No. 100-461. EPA Reg No. 9779-210 states maximum right of way application
rate of 1 lb ai/A is based on BEAD estimates (QUA memo from A. Halvorson 1/29/1999).
(3) Granular - EPA Reg. No. 100-469 (Diazinon 14G) and Diazinon Granular Lawn Insect Cont

(b) Daily acres treated are are based on HED's estimates of acreage (or gallonage) that wou
concern.

(c) Margin Of Exposure (MOE) = Inhalation (for all time frequencies) LOAEL (0.026 mg/kg/day)/
exposure (non-absorbed). Where Daily Dermal Dose (mg/kg/day) = [Unit exposure (mg/lb ai)
BW, and Daily inhalation Dose (mg/kg/day)= Unit exposure [(g/lb ai) * (1mg/1000 g) Co

treated]/70 kg BW}. The target MOE is 100 for short-term dermal exposure, and is 300 f
inhalation exposures.

(d) Baseline dermal unit exposure represents long pants, long sleeved shirt, no gloves, open
application or backpack dermal assessment.

(e) Additional Personal Protective Equipment (PPE) to reduce dermal exposures = workers wear
Layer Clothing with Chemical Resistant Gloves (DLC, CRG)]. PPE data are not available fo
a 90% protection factor.

(f) Engineering Controls = single layer clothing and no gloves (except where noted chemical r
systems and enclosed cab tractors.

(g) The following scenarios, designated with a '*' have the potential for long-term exposure

(h) The 0.08 lb ai/gal is used for longer residual. Both the 0.04 and 0.08 lb ai/gal are for
livestock areas. Paintbrush and airless sprayer are used for fly control in livestock ar

(i) Typical, average application rate of 3.7 lb ai/A is based on BEAD estimates (QUA memo fro

(j) Walnut foliar spray from EPA Reg 100-460 for wettable powder and EPA Reg. 100-461 for liq

(k) Acreage treated of 40 acres is applicable to the concentrate (20 gal/A) as per EPA Reg 10
liquid Ag 500).

(l) Based on a lindane seed treatment study (MRID 44405802) based on a dust formulation.

4.0 POSTAPPLICATION EXPOSURE AND RISK ESTIMATES

EPA has determined that there is potential exposure to persons entering treated sites (e.g., harvesters) after application is complete. Postapplication exposure data were required during the diazinon DCI of the reregistration process, since, at that time, one or more toxicological criteria had been triggered. Two postapplication studies (i.e., residue dissipation) have been submitted along with the registrant's participation in the Agricultural Reentry Task Force (ARTF). The two crop-specific residue study data are used in HED's risk assessment as surrogates to represent other crops not monitored but currently registered. Activity-specific transfer coefficients, developed by the ARTF, are also used to assess postapplication exposures and risks.

This revision to the diazinon RED incorporates the revised toxicological endpoint and the revised policy for agricultural transfer coefficients (i.e., HED Exposure SAC Policy 3.1: *Agricultural Transfer Coefficients* dated August 7, 2000). The revised transfer coefficient policy entailed linking worker activities to more specific crop groupings and using the newly available occupational postapplication exposure data from the ARTF. In the new policy, transfer coefficients were selected to represent the activities associated with 18 distinct crop/agronomic groupings based on different types of vegetables, trees, berries, vine/trellis crops, turf, field crops, and bunch/bundle crops. Diazinon uses were identified in 13 of the 18 groupings. The following 13 crop groupings are used to assess the postapplication exposures to diazinon:

(1) Low berry;
(2) Bunch/Bundle;
(3) Field row crop, low & medium;
(4) Field row crop, tall;
(5) Field-grown nursery ornamentals;
(6) Deciduous tree fruit;
(7) Nut Trees;
(8) Root vegetables;
(9) Cucurbit vegetables;
(10) Fruiting vegetables;
(11) Brassica vegetables;
(12) Leafy vegetables; and
(13) Vine & trellis crops.

The revised policy on transfer coefficients has been expanded substantially to more closely link job practices to the crop groups as indicated above. It has also more clearly defined the scope of the types of tasks/job functions that should be addressed using these transfer coefficients. The policy also describes which kinds of jobs result in exposures that cannot be addressed with transfer coefficients or those that are of special concern such as vacuuming while harvesting tree nuts. It also describes in more detail those exposures that are considered to be negligible as outlined in HED Exposure SAC Policy 11: *Mechanized Agricultural Practices and Post-Application Exposure Assessments* dated May 1, 2000 (e.g., mechanical harvesting and weeding). It should be noted that mechanical harvesting and other similar

low/no exposure activities should be addressed by the guidance contained in Policy 11 which is based on the Worker Protection Standard guidance for such activities (40CFR 170). If there are exposures that are of special concern, then additional data or characterization in the risk mitigation phase of the reregistration process should be considered.

4.1 Postapplication Exposure Assumptions

This section is organized into four subsections. Subsection 3.1.1 provides a brief discussion of submitted studies; subsection 3.1.2 provides a summary of the available Dislodgeable foliar residues (DFRs); subsection 3.1.3 provides a summary of the transfer coefficients used to relate the environmental concentrations (i.e., DFRs) to dermal exposure; and subsection 3.1.4 provides an acknowledgment of the uncertainties in this assessment.

4.1.1 Submitted Studies

Two Dislodgeable foliar residue (DFR) studies were used in the assessment of occupational postapplication exposures.

- **MRID No. - 402029-02. Degradation of Dislodgeable Diazinon Residue on Chinese Cabbage and Broccoli Foliage in Santa Barbara and San Luis Obispo Counties. December 6, 1985.**

This study was conducted by California Department of Food and Agriculture Division of Pest Management, Environmental Protection and Worker Safety, Worker Health, and Safety Branch, at Sacramento, California. During spring and early summer of 1984, five fields (four Chinese cabbage fields and one broccoli/cauliflower field) were treated with diazinon. All five fields received the maximum application rate specified on the label, of one pound (0.5 lbs. a.i.) of Diazinon 50W (EPA Reg. No. 100-460) per acre applied by ground equipment in a tank mix of 50 to 65 gallons of water per acre. Triplicate samples were taken at each time interval. Dislodgeable residues from the leaf surfaces were monitored on 0, 1, 2, 3, and 7 days after treatment.

The following issues and concerns were identified: The quality assurance/quality control data were not provided; for example the analytical method validation, field fortification data, storage stability, etc., and the time when pesticide residues were dislodged from leaf punches was not provided (the recommended time for sample analysis should be done within 4 hours from the time of its collection).

- **MRID No. - 404666-01. Diazinon Dislodgeable Residue Study. Ciba-Geigy Corporation. October 22, 1987.**

This study measured Dislodgeable foliar residues (DFRs) in Clovis, CA. Diazinon 50W was applied to orange trees at a rate of 1 lb ai/acre in 100 gallons of water per acre using an airblast sprayer. DFR levels were recorded as $\mu g/cm^2$ for single-sided leaf areas. The data in this analysis have been adjusted to

double-sided leaf surface areas to be consistent with the available transfer coefficients. Triplicate samples were collected and dislodged with a detergent solution. Laboratory and field fortified samples along with the storage stability results showed greater than 90 percent recovery. Samples were collected on 0, 1, 2, 5, 7, 14, 21, 28, and 35 days after treatment (DAT). Samples were non detectable (less than 0.004 µg/cm^2) on 14, 21, 28, and 35 DAT.

4.1.2 Summary of Dislodgeable Foliar Residues

The postapplication monitoring studies submitted provide DFR data for cabbage and citrus. Although the citrus use is not longer supported by the registrant, the data generated in this study can be used as surrogates for other crops. Because of the absence of additional DFR data for the various other crops treated with diazinon, the available DFR data are used as surrogate residue values for other crops using best scientific judgement. Uncertainties are introduced into the assessment when crop-specific residues are used to estimate residues from other types of crops, however, it is believed to be more realistic than assuming a default initial residue value based on the application rate and an assumed dissipation rate per day. The DFR data are presented in the tables below.

Citrus (Orange) DFR Data:

The data set for citrus (MRID 404666-01) is based on an application rate of 1 lb ai/acre. The field measured values and predicted (i.e., linear regression analysis of field measured values) DFR data at 1 lb ai/acre are provided in Table 6. For data translated to other crops, the DFR data are normalized in the assessment to the appropriate application rate for that crop grouping.

Table 6
Summary of Citrus Dislodgeable Foliar Residue Data

Crop	Predicted DFR (µg/cm^2) -- (Values in Parentheses Are Field Measured Values)								Half-life (days)	R^2
	0 DAT	1 DAT	2 DAT	3 DAT	4 DAT	5 DAT	6 DAT	7 DAT		
Orange	0.040 (0.173)	0.031 (0.036)	0.023 (0.014)	0.018	0.014	0.010 (0.0032)	0.0080	0.0061 (0.0033)	2.6	0.65

Cabbage DFR Data:

The data set for cabbage (MRID 402029-02) is based on an application rate of 0.5 lb ai/acre. The individual field measured values for all 5 sites (i.e., cauliflower, broccoli, and chinese cabbage) was used in the linear regression analysis. The predicted and average of field measured values for the DFR data at 0.5 lb ai/acre are provided in Table 7. For data translated to other crops, the DFR data are normalized in the assessment to the appropriate application rate for that crop grouping.

Table 7 Summary of Cabbage Dislodgeable Foliar Residue Data										
Crop	**Predicted DFR (µg/cm²) -- (Values in Parentheses Are Field Measured Values)**								**Half-life (days)**	**R^2**
	0 DAT	**1 DAT**	**2 DAT**	**3 DAT**	**4 DAT**	**5 DAT**	**6 DAT**	**7 DAT**		
Cabbage	0.164 (0.33)	0.088 (0.088)	0.048 (0.047)	0.026 (0.011)	0.014	0.0074	0.0040	0.0022 (0.0053)	1.1	0.75

4.1.3 Summary of Transfer Coefficients

Transfer coefficients (Tc) are used to relate the leaf residue values to activity patterns (e.g., harvesting) to estimate potential human exposure. Harvesting activities are assessed in this RED using activity-specific transfer coefficients from HED's Exposure Science Advisory Council *Policy #3.1 Agricultural Transfer Coefficients* which includes the newly submitted ARTF data. Table 8 reports the transfer coefficients used to estimate potential exposure levels for all crops treated with diazinon to determine the margin of exposure (MOE). The transfer coefficient listed in the table is for hand harvesting (unless noted). The transfer coefficients in parentheses are the range of values for the different activities. For example, the low transfer coefficients generally represent low contact activities such as weeding, scouting, and irrigating. High transfer coefficients generally represent activities with more foliar contact such as thinning, hand harvesting, etc.

Table 8 Crop Groupings: Selected Transfer Coefficients, Treated Crops, and Rates			
Transfer Coefficient Grouping (a)	**Specific Transfer Coefficient (cm2/hr) (b)**	**diazinon Specific Crops (c)**	**Max Foliar Rate (lb ai/acre) (d)**
Low berry	1,500 (400 to 1800)	Blackberries, raspberries, blueberries, cranberries, strawberries	1 to 3
Bunch/Bundle	2,000 (100 to 2300)	hops	1
Field row crop, low & medium	2,500 (100 to 2760)	beans, peas	0.75
Field row crop, tall	17,000 (100 to 25,000)	sweet corn, sorghum	1.25
Field grown nursery crops	7,000 (2400 to 13000)	carnation, chrysanthemum (exposure data are not available for ball/burlap other types of ornamentals such as azalea, boxwood, dogwood, juniper, etc.)	2
Deciduous tree fruit	3000 harvest 8000 thinning	apples, apricots, cherries, figs, nectarines, peaches, pears, plums	2
Nut tree	2500 (200 to 5000)	Walnut foliar treatment (almonds dormant only)	3

Table 8
Crop Groupings: Selected Transfer Coefficients, Treated Crops, and Rates

Transfer Coefficient Grouping (a)	Specific Transfer Coefficient (cm2/hr) (b)	diazinon Specific Crops (c)	Max Foliar Rate (lb ai/acre) (d)
Root vegetables	2,500 (140 to 2800)	beets, carrots, onions, parsnips, potatoes, radishes	0.5
Cucurbit vegetables	2,500 (490 to 2800)	cucumbers, melons	0.75
Fruiting vegetables	1,000 (490 to 1900)	peppers, tomatoes	0.75
Brassica vegetables	5,000 (1700 to 7600)	cole crops	0.5
Leafy vegetables	2,500 (490 to 2800)	lettuce, parsley, spinach, swiss chard	0.5
Vine & trellis crops	5,000 harvest 10,000 girdling, cane turning	grapes	1

a DFR data for citrus were used to represent the deciduous tree fruits and tree nuts. The cabbage DFR data were used for all other crop groupings.

b The transfer coefficient listed is for hand harvesting (except where noted). The values listed in parentheses represent other exposure activities such as scouting, weeding, pruning, etc.

c The diazinon treated crops are based on EPA Reg. Nos. 34704-248, 100-460, 9779-210, 100-461, 100-784. The list of diazinon treated crops maybe incomplete; any missing crops can be added to the appropriate category.

d The maximum application rate is based on foliar applications. The higher labeled rates (e.g., 4 lb ai/acre) are for preplant soil incorporated uses. Ornamental rate is assessed for aphids, mites, whiteflies, etc because the transfer coefficient represents cut flowers. Rate assumes 400 gallons/acre. The higher ornamental rate (up to 6 lb ai/acre assuming 400 gallons/acre) is for insects such as webworms and leafrollers on ornamental trees and shrubs.

4.1.4 Summary of Uncertainties

The postapplication exposure assessment encompasses the major uses of diazinon throughout the country. Because of the nature of the scope of the assessment (i.e., assessing all crops across a wide variety of climates with limited data), many assumptions are necessary to assess the risk. The assumptions and uncertainties are identified below to be used in risk management decisions:

- *Crop Specific Residues:* A multitude of crops are treated with diazinon and crop-specific residue data are only available for two crops. Therefore, the use of the available data to "simulate" residues on other crops introduces uncertainties in the setting of restricted-entry intervals. It is reasonable to believe that the residues monitored in the available studies approximate the residues on other crops, but the extent that these residues might be an under- or overestimate is unknown.

- *Extrapolation/Normalization of Residues:* The cabbage and citrus residues were not monitored at the maximum application rate specified on diazinon labels for all foliar treatments. Therefore, the residues were normalized from the rate used in the study (1 lb ai/acre for citrus and 0.5 lb ai/acre for cabbage) to reflect the maximum foliar application rates. Normalizing the residues to

the maximum application rate is a standard practice used by HED so as not to underestimate the residues. In most cases the application rates were not extrapolated to such a degree that may significantly overestimate the residues. However, additional refinement of the DFR data for berries, ornamentals, and walnuts at their higher application rates may be warranted.

C *Transfer Coefficients:* The transfer coefficients selected are based on the activities monitored by ARTF. A wide range of transfer coefficients are available and are provided in HED's revised policy for agricultural transfer coefficients (i.e., HED Exposure SAC Policy 3.1: *Agricultural Transfer Coefficients*). The transfer coefficients selected to represent the crop groupings are considered to be in the high end of the range, but not the maximum. A detailed review of the ARTF data has not been completed at this time.

The ornamental diazinon use encompasses flowers (e.g., carnation and chrysanthemum) and other types of ornamentals such as azalea, boxwood, dogwood, juniper, etc. The ARTF is currently conducting studies to assess the exposures involved with ornamental work activities. The assessment of ornamental diazinon use in this document is based on transfer coefficients for cut flowers. This transfer coefficient is based on values obtained from Brouwer et al (1992) as listed in HED's policy on transfer coefficients. Brouwer et al (1992) data are based on greenhouse applications and is being used in this assessment for outdoor grown ornamentals as a high end estimate for all ornamentals. Further refinements to this assessment can be made once the new ARTF data are submitted.

C *Exposure Frequency/Duration:* The amount of time (e.g., days) that a worker would be involved in postapplication activities in diazinon treated fields is not known with certainty. However, based on the exposure duration for short-term exposure being defined as 1 to 7 days, and the intermediate-term duration from 7 days to several months, this postapplication assessment includes both durations. The daily exposures are calculated using the residue level predicted on a specific day after treatment; subsequent declining residue levels (i.e., average residues under the dissipation curve) are not incorporated into the assessment. Therefore, the short-term assessment is protective of workers rotating into freshly treated fields and being exposed to the same DFR level for 1 to 7 days (i.e., 1 to 7 fields at the day the REI expires).

For the intermediate-term assessment, the daily dissipation of residues to reflect a declining worker's exposure over more than a 7 day period was not factored into the assessment because of (1) the lack of information pertaining to exposure frequency/duration of workers in treated fields, (2) harvesters may travel to multiple treated fields thus encountering higher residues in each field, and (3) the time-to-effect is not reported in the 21-day dermal rabbit study. If the number of days a worker was exposed in a treated field could be determined an average residue value could be used in the assessment. The intermediate-term assessment is a conservative approach to setting REIs because declining residues overtime are not factored into the assessment, and therefore, may overstate the daily exposure a worker receives over time. Based on the rapid dissipation of diazinon, the intermediate-term MOEs reported most likely overstate the exposures.

- *Timing of Application:* Many of the diazinon uses involving higher application rates are for preplant soil incorporated uses. MOEs are provided in this assessment only for the foliar applications (e.g., almonds are treated at 3 lb ai/acre as a dormant only application).

- *Children Postapplication Activities (e.g., harvesting and/or bystander)*: GAO (2000) raised the following question in its report, *Pesticides: Improvements Needed to Ensure the Safety of Farmworkers and Their Children* -- How can the current restricted entry intervals (REIs) calculations which are based on body weights be protective of children? This report surmised that "other factors being equal" the lower body weight of a child would extend the REI. However, the dermal dose used to establish REIs is based on several factors in addition to the median adult male/female body weight including the median adult male/female surface area and the transfer coefficient (related to body surface area). The following calculation describes HED's position that the current method to estimate REIs is protective of children 12 years old that are harvesting crops. The 12 year old age was selected from the child labor requirements in agriculture under the Fair Labor Standards Act (FLSA). Exceptions to the FLSA include 10 year olds that are permanent residents that "hand harvest short season crops" and any minors of the farm owner/operator. The quantitative data indicate that the median body surface area (cm^2) to the median body weight (kg) ratio of a 12 year old compared to that of an adult results in a 18 percent underestimate of the child [(((child 13700 cm^2 /44 kg) - (adult 18440 cm^2 /70 kg)) / (adult 18440 cm^2 /70 kg)) x 100]. Historical transfer coefficient data indicate that the higher the productivity of a worker the higher the transfer coefficient. HED believes that it is reasonable to assume that the productivity of a 12 year old is less than that of an adult. HED believes that transfer coefficients for 12 year olds are lower than for adults and that the difference in the magnitude of the transfer coefficient will nullify the 18 percent underestimate attributed to the ratio of body surface area to body weight.

4.2 Risk From Occupational Postapplication Exposures

This section is organized into two subsections. The first subsection discusses the REIs for each of the crop groupings. The second subsection discusses the import of the spray drift/track-in exposures to children in agricultural areas.

4.2.1 Summary of Postapplication Reentry Risks

As discussed above, diazinon can be used on crops encompassing 13 of 18 crop groupings identified in HED's Exposure Science Advisory Council *Policy #3.1 Agricultural Transfer Coefficients.* Within each of the crop groupings several levels of exposure activities have been identified ranging from "low" activities such as weeding and scouting in immature plants to very high activities such as hand harvesting sweetcorn to detasseling. Only the foliar application rates were used to quantify postapplication exposures. The label directions for the maximum application rates (in most cases up to 4 lb ai/acre) are for preplant soil incorporated uses.

Tables 9 and 10 report a daily MOE summary of the high end exposure activities (i.e., hand harvesting in

most instances) for the short-term and intermediate-term durations, respectively. The MOEs are reported so that the risk managers can determine appropriate restricted-entry intervals (REIs). Exceptions to hand harvesting activities (e.g., scouting, weeding, pruning, thinning, etc.) have also been assessed and the associated MOEs are attached as Appendix B. Appendix B of the postapplication assessment includes a detailed accounting of the transfer coefficients (values used as well as the range available in the ARTF data base), DFR levels, potential dermal dose, and MOEs for each activity level. Finally, Table 11 summaries the days after treatment that the MOEs are 100 for hand harvesting for the short- and intermediate-term durations.

The MOEs reported in these tables and presented in Appendix B are derived from the following equations:

- Dermal dose in (mg/kg/day) = {[DFR (µg/cm^2)]* transfer coefficient (T_c) * 8 hours worked per day * 0.001 mg/µg conversion / 70 kg body weight}; and

- The Margin of Exposure = Dermal NOAEL (mg/kg/day) / Dermal Dose (mg/kg/day).

Mushroom houses: No data were submitted in support of postapplication exposures for workers re-entering mushroom houses. EPA has identified potential dermal and inhalation exposures resulting from this indoor application. The Diazinon 50W label (EPA Reg. No. 100-460) directions for mushroom houses is to use a spray dilution rate of 0.04 to 0.05 lb ai/gallon and apply "on outside and inside walls, floors and sideboards of mushroom houses after compost has been pasteurized by heating ... and spray over the plastic covering the beds and trays after spawning." Potential dermal exposures in mushroom houses may arise from workers contacting treated surfaces as all surfaces may be treated. The potential inhalation exposures may result from air concentrations of diazinon in the mushroom house resulting from the application before or after ventilation. Additional data are needed to estimate the potential for dermal exposure in mushroom houses including (1) identification of mushroom house activities that may result in dermal contact, (2) the residue levels on the sideboards and plastic covering the beds and trays, and (3) direct dermal exposure measurements or transfer coefficients. Additional data are also needed to determine air concentrations of diazinon over time. In lieu of air concentration data to calculate exposure/risk, HED determined an allowable air concentration based on the inhalation LOAEL of 0.1 mg/m^3 from a 21-day whole body aerosol study exposing rats 6-hours per day and the uncertainty factor of 300. The estimated 6 hour time-weighted-average (TWA) allowable air concentration is 0.0003 mg/m^3 (i.e., LOAEL of 0.1 mg/m^3 divided by 300 UF). This calculation assumes that the rat and human activity level for a breathing weight is equivalent. The limit of detection (LOD) from the air sampling portion of the diazinon lawn treatment study (MRID 449591-01) is listed as 0.0006 mg/m^3 (see study results in this chapter for actual air concentration levels at specific time intervals).

4.2.2 Summary of Postapplication Spray Drift/Track-In Risks

HED has concerns for the potential for children's exposure in the home as a result of agricultural uses of diazinon. Environmental concentrations of diazinon in homes may result from spray drift, track-in, or from redistribution of residues brought home on the farmworker's clothing. Potential routes of exposure for children may include incidental ingestion and dermal contact with residues on carpets/hard surfaces.

There are limited data in literature that quantifies the levels of diazinon in household dust. These residues may persist indoors and the resulting exposures are of a potential chronic nature. It is not known at this time if the low levels in carpet dust would correspond to an absorbed dose in a child. The results from Bradman et al. (1997) are briefly discussed to illustrate concern that elevated diazinon residues maybe found in farm worker's homes. Bradman et al. (1997) monitored house dust in homes along with handwipe samples from children. The highest diazinon levels in house dust were found in farm worker residents. The results of the house dust are not reported here because the homes and surfaces monitored varied and contain small sample sizes. The values reported for diazinon residues on the farm worker's children's dominant hand (n=4, ages 1 to 2) are ND, 52, 125, and 220 ng. Readers are referred to the article for a more in-depth review.

The diazinon assessment reflects the Agency's current approaches for completing residential exposure assessments based on the guidance provided in the *Draft: Series 875-Occupational and Residential Exposure Test Guidelines, Group B-Postapplication Exposure Monitoring Test Guidelines*, the *Draft: Standard Operating Procedures (SOPs) for Residential Exposure Assessment*, and the *Overview of Issues Related to the Standard Operating Procedures for Residential Exposure Assessment* presented at the September 1999 meeting of the FIFRA Scientific Advisory Panel (SAP). The Agency is, however, currently in the process of revising its guidance for completing these types of assessments. Further research into children's exposures resulting from agricultural uses of pesticides are being conducted by the Agency's Office of Research and Development through the STAR (Science to Achieve Results) grant program. The STAR program can be accessed at ***http://es.epa.gov/ncerqa/grants/*** Modifications to this assessment shall be incorporated as updated guidance becomes available. This will include expanding the scope of the residential exposure assessments by developing guidance for characterizing exposures from other sources already not addressed such as from spray drift; residential residue track-in; and exposures to farm worker children.

Table 9
Short-term Postapplication Assessment for Diazinon Treated Agricultural Crops (including ornamentals)

DAT (a)	Crop Groupings: MOEs for Hand Harvesting (b,c,d)												
	Berry	Bunch	Field low	Field tall	Ornamentals	Tree fruit (thinning)	Tree Nut	Veg: root	Veg: cucurbit	Veg: fruit	Veg: Brassica	Veg: leafy	Vines (girdling
0	6	13	14	1	2	37 (14)	29	21	14	36	11	21	5 (3)
1	11	25	26	2	4	48 (18)	31	40	26	66	20	40	10 (5)
2	20	46	49	4	7	62 (23)	33	74	49	120	37	74	18 (9)
3	38	85	91	8	12	82 (31)	36	140	91		68	140	34 (17)
4	70	160	170	15	23	110 (40)	38		170		130		63 (32)
5	130			28	42	(52)	41						120 (59)
6				51	78	(68)	43						(110)
7				95	140	(89)	46						
8				180		(120)	50						
DAT 19							100						

(a) DAT = days after treatment.
(b) The MOEs reported are for hand harvesting. See Appendix A for exceptions to hand harves
(c) See Appendix A for DFR levels, dose, and MOE calculations.
(d) Short-term dermal NOAEL = 1.0 mg/kg/day (21-day rabbit dermal study with a 100 target MOE

Table 10
Intermediate-term Postapplication Assessment for Diazinon Treated Agricultural Crops (including ornamentals)

DAT (a)	Crop Groupings: MOEs for Hand Harvesting (b,c,d)												
	Berry	Bunch	Field low	Field tall	Ornamentals	Tree fruit (thinning)	Tree Nut	Veg: root	Veg: cucurbit	Veg: fruit	Veg: Brassica	Veg: leafy	Vines (girdling
0	6	13	14	1	2	37 (14)	29	21	14	36	11	21	5 (3)
1	11	25	26	2	4	48 (18)	31	40	26	66	20	40	10 (5)
2	20	46	49	4	7	62 (23)	33	74	49	120	37	74	18 (9)
3	38	85	91	8	12	82 (31)	36	140	91	230	68	140	34 (17)
4	70	160	170	15	23	110 (40)	38	250	170	420	130	250	63 (32)
5	130	290	310	28	42	140 (52)	41	470	310		230	470	120 (59)
6	240			51	78	180 (68)	43				440		220 (110)
7	450			95	140	240 (89)	46						400 (200)
8				180	270	310 (120)	50						(370)
9				330	500	(150)	53						
10						(200)	57						
11						(260)	60						
12						(340)	65						
DAT 30							210						

(a) DAT = days after treatment.
(b) The MOEs reported are for hand harvesting. See Appendix A for exceptions to hand harves
(c) See Appendix A for DFR levels, dose, and MOE calculations.
(d) Intermediate-term dermal NOAEL = 1.0 mg/kg/day (21-day rabbit dermal study with a 300 tar

Table 11 Summary of "The Days After Treatment" to Reach the Target MOE for Hand Harvesting (a)					
Crop Grouping	**Diazinon Specific Crops**	**Max Foliar Rate (lb ai/acre)**	**Days After Treatment Target MOE Achieved**		**PHI (days)**
			Short-term (Target MOE 100) (b)	**Intermediate-term (Target MOE = 300) (c)**	
Low berry	Blackberries, raspberries, blueberries, cranberries, strawberries	3 (ranges from 1 to 3)	4 to 5 (strawberries @ 1 lb ai/A = 3)	6 to7 (strawberry @ 1 lb ai/A=4 to 5)	5 to 7
Bunch/Bundle	hops	1	3	5	14
Field row crop, low & medium	beans, peas	0.75	3	5	7
Field row crop, tall	sweet corn, sorghum	1.25	7	9	7
Field grown nursery ornamentals	carnation, chrysanthemum (exposure data are not available for ball/burlap other types of ornamentals such as azalea, boxwood, dogwood, juniper)	2	6 to 7	8	12 hr REI
Deciduous tree fruit	apples, apricots, cherries, figs, nectarines, peaches, pears, plums	2	3 to 4 (7 to 8 for thinning)	8 (11 to12 for thinning)	21
Tree nuts	Walnuts (almonds dormant spray only)	3	18	greater than 30	45
Root vegetables	beets, carrots, onions, parsnips, potatoes, radishes	0.5	2 to 3	4 to5	14+
Cucurbit vegetables	cucumbers, melons	0.75	3	5	7
Fruiting vegetables	peppers, tomatoes	0.75	2	3 to 4	1 to 5
Brassica vegetables	cole crops	0.5	3 to 4	5 to 6	7
Leafy vegetables	lettuce, parsley, spinach, swiss chard	0.5	2 to 3	4 to 5	10+
Vine & trellis crops	grapes	1	4 to 5 (6 for girdling, cane turning)	4 to 5 (7 to 8 for girdling, cane turning)	28

(a) Results are for the highend exposure activity of hand harvesting. Exceptions (i.e., activities with lower exposure potential) are listed in Appendix B.

(b) Short-term dermal NOAEL = 1 mg/kg/day (21-day rabbit dermal study with a 100 target MOE).

(c) Intermediate-term dermal NOAEL = 1 mg/kg/day (21-day rabbit dermal study with a 300 target MOE).

5.0 RESIDENTIAL ASSESSMENT

5.1 Residential Handler Exposure and Risk Estimates

5.1.1 Outdoor Use

5.1.1.1 Residential Handler Exposure Data and Assumptions

Diazinon has a wide variety of outdoor residential uses including lawn and ornamental treatments, spot treatments, use on vegetable gardens and around the house perimeter. The current registered labels permit residents to mix/load/apply both liquid and granular formulations at rates up to 4 and 4.4 lb a.i. per acre, respectively up to 4 or more times per year. Some labels do not specify a limit on number of applications, or state apply as needed. Diazinon is applied by many methods including spray equipment (hose-end sprayer, handwand), and granular spreaders. Residential handlers may receive dermal and inhalation exposure to diazinon when mixing, loading and applying. All residential handler use patterns are considered to result in short-term (1-7 day) exposures.

HED evaluated the following six residential handler exposure scenarios resulting from diazinon's registered uses:

(1) Mixing/loading/applying liquids with a low pressure handwand (spot treatment);
(2) Mixing/loading/applying liquids with a backpack sprayer (spot treatment);
(3) Mixing/loading/applying liquids with a ready-to-use (RTU) hose-end sprayer;
(4) Mixing/loading/applying liquids with a conventional garden hose-end sprayer;
(5) Loading/applying with a push-type spreader; and
(6) Loading/applying granules with a belly grinder (spot treatment).

In July 2000, Novartis stated that they do not plan to support the belly grinder and airless sprayer methods of application. However, HED included the belly grinder analysis for completeness, since the labels have yet to be modified to reflect this change.

The registrant submitted one chemical-specific handler study that assessed three residential handler application scenarios, which was utilized to the greatest extent possible. This study conducted both biomonitoring (i.e., urinary measurement of a unique diazinon metabolite, G-27550, following exposure) and/or passive dosimetry measurements on 42 different residential applicators. In addition, passive dosimetry exposure data from a recently submitted Occupational and Residential Exposure Task Force (ORETF) handler study was used. This study assessed residential handler exposures to diazinon resulting from a conventional hose-end sprayer (dial type sprayer) and a ready-to-use hose-end sprayer (MRID 44972201). In this study, residents treated 5,000 ft^2 of lawn at the maximum application rate of 4 lb ai/acre diazinon, resulting in a total of 0.5 lb ai handled per replicate. The same ORETF study (MRID 44972201)

assessed residential handler exposures to dacthal resulting from a granular push-type spreader. This study was used as a surrogate to assess diazinon, where the residents treated 10,000 ft^2 of lawn at a typical rate of 2 lb ai/acre, resulting in a total of 0.45 lb ai handled per replicate. In the absence of chemical-specific data, HED relied on information from the Draft Residential Standard Operating Procedures (SOPs - December 1997), and updated assumptions (2000 SOPs). The Residential SOPs were used to assess the backpack sprayer and the belly grinder exposure scenarios. The residential unit exposure numbers are derived from the Pesticide Handler Exposure Database (PHED) Version 1.1. Dermal Unit Exposures are based on homeowner applicators wearing short sleeve shirts and short pants, and no gloves (sss, sp, ng) open mixing/loading; except for backpack sprayers. Chemical resistant gloves are included for the backpack assessment because the "no glove" scenario is not available for hands. To account for the "no glove" scenario, a back calculation was conducted using a 90% protection factor to obtain the appropriate unit exposure value for a no glove scenario for backpack application. Inhalation Exposure Unit estimates assume no respirator.

Dermal and inhalation daily doses (mg/kg/day) for most residential handlers were calculated with the following equation:

$$\text{Dermal or Inhalation daily dose (mg/kg/day)} = \frac{\text{Rate (lb ai/A)} \times \text{UE (mg /lb ai)} \times \text{Acres Treated (A/day)}}{\text{BW (kg)}}$$

Where:

Rate (Application Rate)	=	maximum application rate on product label (lb ai/A)
UE (Unit Exposure)	=	Exposure value (mg/lb ai handled) derived from either chemical-specific studies, or August 1998 PHED Surrogate Exposure Table for handlers wearing short sleeves, short pants and no gloves as shown in Appendix B of the 1997 Draft SOPs for Residential Exposure Assessments. The UE values are central tendency estimates based on the distribution of the data set (i.e., geometric mean for lognormal data sets, arithmetic mean for normal data sets and median for other data distributions).
Acres Treated	=	Maximum number of acres treated per day (A/day)
BW	=	body weight (kg)

The following assumptions (which include *current* HED standard values) were used to calculate dermal and inhalation exposures.

* For the liquid exposure assessments, the maximum application rate from Ortho® Diazinon Ultra™ (EPA Reg # 239-2643, Liquid water base concentrate, 22.4% ai) of 4 lbs. ai/acre was assumed.

* For the granular exposure assessment, the maximum application rate from Ortho® Diazinon Soil and Turf ™ (EPA Reg # 239-2479, granular, 4.84 % ai) of 4.4 lbs. ai/acre was assumed.
* For the liquid formulation, handlers were assumed to be using a low-pressure hand wand for spot

treatments to 1,000 ft^2 areas or a conventional or ready-to-use (RTU) garden hose-end sprayer for broadcast to a 0.5 acre lawn. The 0.5 acre value is the standard HED-recommended assumption and represents the mean to upper-percentile range of the distribution of lawn size. Recent lawn size survey data suggest that up to 0.5 acre represents 73% of the 2,300 respondents, while nearly 16% of the respondents had lawn sizes that ranged from 0.57 to 1 acre (Outdoor Residential Use and Usage Survey and National Gardening Association Survey 1999). In this study, 2,300 respondents of 4,100 knew the size of their lawn.

* Handlers using the granular formulation were assumed to be using a 'push type' granular spreader to treat a lawn size of 15,000 ft^2 (0.344 acre), and a belly grinder for spot treatments to 1,000 ft^2 areas. Some granular labels state that residents should only treat 15,000 ft^2 per day (0.344 acre)(EPA Reg # 100-468). HED notes, however, that some labels currently do not restrict the area treated (EPA Reg 3239-2479), and these labels should be modified to add such a restriction.

* The Residential SOP/PHED dermal unit exposures for the backpack sprayer and the belly grinder are 5.1 and 110 mg/lb ai handled, respectively. The Residential SOP/PHED inhalation unit exposures for the backpack sprayer and the belly grinder are 0.03 and 0.062 mg/lb ai handled, respectively. These values are from Appendix B of the 1997 Draft SOPs for Residential Exposure Assessments. As noted previously, the chemical-specific dermal and inhalation unit exposures are central tendency estimates based on the distribution of the data set (i.e., geometric mean for lognormal data sets, arithmetic mean for normal data sets and median for other data distributions).

* Residential handler weight is 70 kg.

C The overall estimate of dermal and inhalation exposure is believed to represent central to high-end values for the 0.5 acre treatment area.

Chemical-specific dermal and inhalation exposure estimates from the passive dosimetry measurements, and absorbed dose estimates from biomonitoring data were also used to the greatest extent possible. Biomonitoring data are available for three scenarios: (1) low pressure handwand, (2), ready-to-use hose end sprayer and (3) conventional hose-end sprayer (MRID 45184305). HED reviewed this study in a memorandum from D. Smegal to B. Chambliss/D. Drew, November 29, 2000, D268247. In this study, the unique metabolite of diazinon, G-27550, was measured in urine for 2-3 days following exposure. In evaluating the biomonitoring data, both the central-tendency (i.e., geometric mean or arithmetic mean) and the 90^{th} percentile absorbed diazinon dose estimate were used to estimate exposure and risks. The 90^{th} percentile values are presented because the biomonitoring data represent measured exposures to individuals and are not extrapolated using high end assumptions. As shown on Table 12, biomonitoring studies had residents handling 4 gallons of product (0.021 lb ai per replicate) for handwand or 0.5 lb ai per replicate for the hose-end sprayer to treat 5000 ft^2. HED typically evaluates exposures for 0.5 acre or 21,800 ft^2 for the hose-end sprayer. The hose-end sprayer biomonitoring data for 5,000 ft^2 will underestimate exposure to individuals treating larger lawns. The results are reported for the 5,000 ft^2 treatment area because that was consistent with packaging size and it was also the area treated in the registrant study. HED notes that diazinon is packaged in 1 quart ready-to-use containers that treat 5,000 ft^2. To treat larger lawns,

additional packages would have to be purchased. HED also extrapolated the biomonitoring data using the mean results to 0.5 acre to be consistent with current HED-policy.

5.1.1.2 Residential Handler Risk Characterization

The target margin of exposure (MOE) is 100 for handler short-term dermal residential exposures to diazinon. For residential handler inhalation exposures of any duration, the target MOE is 300. A target MOE of 100 is used to assess exposure estimates based on biomonitoring data because these exposure estimates are compared to the short-term oral NOAEL of 0.25 mg/kg/day. An oral NOAEL was selected in the absence of an absorbed dermal NOAEL. Exposure and risk estimates for these scenarios can be found in Table 12. Estimated risks, expressed as MOEs, for all residential handler scenarios are less than 100 for dermal and 300 for inhalation based on unit exposures from passive dosimetry, except for inhalation MOEs for the push-type spreader scenario (MOE=1,300). Therefore, these scenarios exceed HED's level of concern. HED also evaluated residential handlers wearing long pants for the push-type granular spreader. As shown on Table 12, the dermal MOEs for this scenario with short pants and long pants are 68 and 520, respectively, indicating that the majority of the dermal exposure is to the lower legs. HED policy is to assume residents wear short pants because it is difficult to enforce clothing requirements for homeowners. HED notes that current diazinon granular labels (EPA Reg No. 239-2479, 100-468) do not recommend applicators wear long pants.

Biomonitoring data were also available for three scenarios: (1) low pressure handwand, (2) ready-to-use hose end sprayer, and (3) and conventional hose-end sprayer (MRID 45184305). As shown on Table 12, the MOEs based on central tendency and 90th percentile exposure estimates as measured in the study (i.e., 5,000 ft^2) are greater than 100, and therefore do not exceed HED's level of concern, except for the 90th percentile conventional hose-end sprayer (MOE=27). However, the geometric mean biomonitoring exposure estimates for the ready-to-use hose end sprayer or the conventional hose end sprayer extrapolated to 0.5 acre result in MOEs less than 100, and therefore, exceed HED's level of concern. These MOEs represent total exposure, because they are based on a total absorbed dose resulting from primarily dermal and inhalation exposure.

As mentioned previously, the diazinon-specific biomonitoring results may underestimate exposure and risk. While biomonitoring data are typically preferred for assessing exposures, HED believes the biomonitoring results for diazinon may underestimate exposure and risk primarily due to:

(1) Possible incomplete urine collection for some individuals (at least 9 of 42 individuals appeared to have low urine volumes). Creatinine measurements were not provided to assist in the determination of complete urine collection.

(2) There is a lack of pharmacokinetic data for the G-27550 metabolite following dermal and inhalation exposure. HED estimated biomonitoring doses assuming the urinary metabolite G-27550 represents 7.9% of diazinon exposure based on a human oral pharmacokinetic study, which may not reflect dermal or inhalation exposures.

For these two reasons, Pest Management Regulatory Agency (PMRA) in Canada does not consider the biomonitoring results to be acceptable for use in generating handler exposure estimates (personal communication with Kristen Macey, 11/21/00).

(3) The biomonitoring risk estimates are based on residents handling 0.5 lb ai per replicate for hose-end sprayer to treat 5000 ft^2, while HED typically evaluates a 0.5 acre or 21,800 ft^2 lawn treatment for the hose-end sprayer.

(4) Biomonitoring results (based on dermal and inhalation exposure) are compared to the short-term oral NOAEL of 0.25 mg/kg/day to calculate MOEs. HED notes that the short-term inhalation LOAEL of 0.026 mg/kg/day is at least 10 times lower than the oral NOAEL. There are significant uncertainties in comparing biomonitoring data resulting from dermal and inhalation exposure to oral toxicity data because of differences in pharmokinetics and toxicity for the routes of exposure. HED believes it is inappropriate to compare the total absorbed dose to the inhalation LOAEL because most of the exposure is via the dermal route. In addition, the available dermal absorption data are variable and do not allow adjustment of the dermal NOAEL of 1 mg/kg/day to an absorbed dose (i.e., dermal absorption ranges from <1 to 58% depending on individual, and equipment type based on MRID 45184305).

A factor that may contribute to the possible over-estimation of risk is that a 21 day inhalation endpoint based on whole body exposure in rats, and a 21 day dermal endpoint in rabbits were used to assess a short-term (often single day) exposure scenario.

As noted previously for occupational handlers, HED estimated total dermal and inhalation risk using an aggregate risk index (ARI) because of different target MOE for dermal (MOE=100) and inhalation (MOE=300) exposure routes. The target ARI is $\geq$1 (i.e., ARIs less than 1 would exceed HED's level of concern). As shown on Table 12, all the ARIs are less than 1, and therefore exceed HED's level of concern for residential handlers, except for residents wearing long pants during granular application with a push type spreader to 0.34 acres (ARI=2.4). These ARIs range from 0.03 for the liquid conventional hose end sprayer assessment using the ORETF data to 0.89 for the backpack sprayer using the Residential SOPs/PHED unit exposure estimates. It should be noted that HED has more confidence in the chemical-specific exposure and risk estimates for the low-pressure handwand (ARI=0.38-0.25) than the exposure and risk estimates based on low quality data available for the surrogate data from PHED (e.g., back calculating a no glove scenario using a protection factor, 11 replicates, and C grade data). The PHED data may underestimate exposure and risks due to the relatively high volatility of diazinon (vapor pressure of $1.4x10^{-4}$ mmHg) relative to the chemical surrogate data in PHED.

Table 12 Short-Term Residential Handler Exposure and Risk Estimates										
Exposure Scenario (Scen. #)	Data Source	Dermal Unit Exposure (mg/lb ai) (a)	Inhalation Unit Exposure (mg/lb ai) (b)	Application Rate (lb ai/acre) (c)	Amount Handled per Day or Area Treated (d)	Daily Dose (mg/kg/day)		MOE		Aggregate Risk Index (ARI) (l) (1 needed)
						Dermal(e)	Inhalation (f)	Dermal (g)	Inhalation (h)	
Mixing/Loading/Applying Liquids										
Liquid Low Pressure Handwand	Novartis Study (MRID 45184305)	12.3 (G.M.) passive dosimetry	0.19 (G.M.) passive dosimetry	4	1000 ft^2 (0.023 acre)	0.016	0.00021	62	130	0.25
		Biomonitoring (see Dose estimates) (n=13)			0.021 lb ai (4 gallons)	0.00075 (A.M.) 0.0014 (90^{th} percentile) (total dose from biomonitoring study)		330 (A.M.) 180 (90^{th} percentile) (total dose) (i)		NA
Backpack Sprayer (2)	Residential SOPs/PHED	5.1(j)	0.03 (j)	4	1000 ft^2 (0.023 acre)	0.007	0.0004	150	660	0.89
Liquid Ready-to-Use Garden Hose-end Sprayer (3)	Novartis Study (MRID 45184305)	1.58 (G.M.) (n=11) passive dosimetry	0.0457 (G.M.) (n=11) passive dosimetry	4	0.5 acres	0.045	0.00131	22	20	0.051
		Biomonitoring (see Dose estimates) (n=15)			5,000 ft^2 (0.11 acre)	0.00061 (G.M.) 0.0022 (90^{th} percentile) (total dose from biomonitoring study)		410 (G.M.) 110 (90^{th} percentile) (total dose) (i)		NA
					0.5 acres	0.0026 (extrapolated from G.M.)		94		NA
	ORETF Diazinon Study (MRID 44972201)	2.6 (G.M.) (n=30) passive dosimetry	0.011 (G.M.) (n=30) passive dosimetry	4	0.5 acres	0.074	0.00031	13	83	0.09
	Combined Data from Novartis and ORETF Studies	2.3 (G.M.) 33 (max) (n=41) passive dosimetry	0.016 (G.M.) 0.16 (max) (n=41) passive dosimetry			0.066	0.0046	15	57	0.084

Table 12
Short-Term Residential Handler Exposure and Risk Estimates

Exposure Scenario (Scen. #)	Data Source	Dermal Unit Exposure (mg/lb ai) (a)	Inhalation Unit Exposure (mg/lb ai) (b)	Application Rate (lb ai/acre) (c)	Amount Handled per Day or Area Treated (d)	Daily Dose (mg/kg/day)		MOE		Aggregate Risk Index (ARI) (1 needed)
						Dermal (e)	Inhalation (f)	Dermal (g)	Inhalation (h)	
Liquid Conventional Hose End Sprayer (4)	Novartis Study (MRID 45184305)	4.68 (G.M.) (n=12) passive dosimetry	0.0114 (G.M.) (n=11) passive dosimetry	4	0.5 acres	0.134	0.00033	7	80	0.058
		Biomonitoring (see Dose estimates) (n=14)			5,000 ft^2 (0.11 acre)	0.00096 (G.M.) 0.0092 (90th percentile) (total dose from biomonitoring study)		260 (G.M.) 27 (90th percentile) (total dose) (i)		NA
					0.5 acres	0.0042 (extrapolated from G.M.)		60		NA
	ORETF Diazinon Study (MRID 44972201)	10.9 (G.M.) (n=30) passive dosimetry	0.016 (G.M.) (n=29) passive dosimetry		0.5 acres	0.311	0.00046	3	57	0.03
	Combined Data from Novartis and ORETF Studies	8.6 (G.M.) 49 (max) (n=42) passive dosimetry	0.015 (G.M.) 0.089 (max) (n=40) passive dosimetry			0.246	0.00043	4	61	0.034

Table 12 Short-Term Residential Handler Exposure and Risk Estimates										
Exposure Scenario (Scen. #)	Data Source	Dermal Unit Exposure (mg/lb ai) (a)	Inhalation Unit Exposure (mg/lb ai) (b)	Application Rate (lb ai/acre) (c)	Amount Handled per Day or Area Treated (d)	Daily Dose (mg/kg/day)		MOE		Aggregate Risk Index (ARI) (1 needed)
						Dermal (e)	Inhalation (f)	Dermal (g)	Inhalation (h)	
Loading/Applying Granules										
Granular Loading/-Applying with Push Type Spreader	ORETF Study with Dacthal (MRID 44972201) (5)	0.68 (G.M) (max 7.9) (shorts, short sleeved shirt, no gloves)	0.00091 (G.M.)	4.4 (maximum)	0.344 acres (15,000 ft2)	0.015 (G.M)	0.00002 (G.M)	68	1,300 (G.M.)	0.59 (G.M)
		0.089 (G.M) (0.52 max) (long pants, short sleeved shirt, no gloves)				0.002		520		2.4
Granular Grinder)	(Residential SOPs/PHED	110 (k)	0.062 (k)	4.4 (maximum)	1,000 ft2 (0.023 acre)	0.159	0.00009	6.3	290	0.059

NA = Not applicable
G.M. = Geometric mean
A.M = Arithmetic mean

(a) Dermal unit exposure from chemical-specific studies based on geometric mean for lognormall distributed data sets. Otherwise, dermal unit exposure were values from Residential SOPs d pants, short sleeved shirt, and no gloves clothing scenario.

(b) Inhalation unit exposure from chemical-specific studies based on geometric mean for lognor distributed data sets. Inhalation unit exposure values from PHED are from Residential SOPs

(c) Application rate is based on the Registrant Study, MRID #449591-01, and the labels, Ortho® concentrate, 22.4% ai, application rate = 4 lbs. ai/A), Ortho® Diazinon Soil and Turf TM (

(d) Amount handled per day values are EPA estimates of acreage treated found in the Residentia push-type spreader based on the labels. One label (EPA Reg # 100-468) restricts the area 239-2479) does not limit the lawn treatment area, and therefore the HED standard default v

(e) Dermal daily dose (mg/kg/day) = daily unit exposure (mg/lb ai) x application rate (lb ai/
(f) Inhalation daily dose (mg/kg/day) = inhalation unit exposure (µg/lb ai) x application rate
1,000 µg) / body weight (70 kg).
(g) Dermal MOE = dermal NOAEL (1 mg/kg/day) / daily dose (mg/kg/day).
(h) Inhalation MOE = LOAEL (0.026 mg/kg/day) / daily dose (mg/kg/day).
(i) Biomonitoring results based on residents handling 4 gallons of product (0.021 lb ai per re
Dose is estimated assuming that the urinary metabolite G-27550 represents 7.9% of diazinon
study, and does not reflect dermal or inhalation exposures. In the absence of reliable de
term oral NOAEL of 0.25 mg/kg/day. There are significant uncertainties in comparing biomo
toxicity data because of differences in pharmokinetics and toxicity for the routes of expo
(j) Dermal unit exposure for the backpack sprayer has low confidence, 8-9 dermal replicates of
inhalation unit exposure has high confidence, and 40 replicates of AB grade data.
(k) Dermal unit exposure for the belly grinder has medium confidence, 20-45 dermal replicates
inhalation unit exposure has medium confidence, and 80 replicates of ABC grade data.
(l) Aggregate Risk Index (ARI) = $MOE_{calculated}$ / $MOE_{acceptable}$ where ARI_{dermal} = $MOE_{calculated}$
$MOE_{calculated\ inhalation}$ / $MOE_{acceptable\ inhalation}$, and ARI (total) = 1 / (1/ARI_{dermal}

5.1.2 **Indoor Use**

Diazinon has a wide variety of residential uses including indoor carpet and crack and crevice treatments. However, the registrants have recently agreed (July 2000) to discontinue to support the registration of indoor uses. This includes use inside any structure or vehicle, vessel, or aircraft and/or on any contents therein including, but not limited to:

A: Inside domestic residences and dwellings (such as houses, apartments, or trailers) or any use therein such as interior surfaces (including associated cracks, crevices, or voids), furnishings (including furniture, rugs, carpeting, and underlayment), houseplants indoors, garbage cans or containers indoors, utility rooms, laundry rooms, drains of any type (including floor drains, sinks or toilets), and in any associated structures or outbuildings such as garages, enclosed porches, crawlspaces (including crawlspaces under raised porches), sheds, and work or hobby buildings.

B. Inside any commercial, industrial or institutional building or structure such as schools (including temporary structures such as trailers), hospitals, retirement homes, nursing homes, hotels, motels, motor courts, military buildings and barracks, offices, shops, stores, shopping malls, garages, warehouses or any storage facilities, manufacturing facilities, repair facilities, both feed/food and non-food/non-feed areas of food/feed handling establishments (including eating establishments such as restaurants, cafeterias and dining halls, canneries, bakeries, meat processing plants, mills, egg processing plants, dairies, and food marketing/storage and/or distribution facilities), athletic or sports facilities, recreation buildings, libraries, museums, and any other private or public buildings and any use therein, such as interior surfaces (including associated cracks, crevices, and voids), furnishings (including furniture, work surfaces or equipment, electrical boxes indoors, rugs, carpeting or underlayment), houseplants indoors, interiorscapes (interior plantscapes, indoor decorative plantings), garbage cans or containers indoors, waste storage areas indoors, utility/mechanical/boiler rooms, locker rooms, storage rooms, lavatories (restrooms, toilet areas), drains of any type (including floor drains, sinks or toilets), crawlspaces, and in any associated structures or outbuildings.

C. Inside any enclosed agricultural building or structure, such as any enclosed livestock living, sleeping, or loafing quarters including barns (but excluding outdoor livestock pens and corrals), enclosed loafing sheds, hog houses, storage buildings, sheds, garages and any other farm buildings.

D. Use in any transportation vehicle including buses, trucks, trailers, containers, ships, boats, barges or other vessels, aircraft, railroad cars (including freight or passenger), or inside any buildings associated with transportation such as bus and train stations, airports, or ports.

E. Dog or cat collars, or in enclosed pet sleeping or living quarters including inside domestic residences, commercial, industrial, institutional or agricultural buildings, veterinary buildings, doghouses, and kennels (but excluding outdoor animal runs and training or exercise areas).

F. Inside greenhouses (including home or commercial)(but excluding shade houses and lath

houses) on any surface including on and under benches, and on any plants contained therein.

5.2 Residential Post-Application Exposure and Risk

5.2.1 Outdoor Use

5.2.1.1 Postapplication Residential Exposure Data and Assumptions

Potential residential postapplication exposures may occur as a result of turf treatment by residents or professional lawn care operator (LCOs). Specifically, adult and child exposures were evaluated as a result of both liquid and granular diazinon lawn treatments that could occur in both residential and recreational settings (i.e., parks, playgrounds). Adults and children may be exposed to diazinon from dermal contact with treated turf and from inhalation of airborne concentrations. Toddlers may also receive short-term oral exposure from hand-to-mouth and object to mouth activities and from incidental ingestion of soil or pesticide granules during post-application activities. All exposures were assumed to be of short-term duration (1-7 days). HED evaluated the following 6 postapplication exposure scenarios associated with liquid and granular turf treatment:

(1) Dermal absorption of diazinon residues on treated turf (adults and children);
(2) Incidental ingestion of diazinon residues resulting from hand to mouth activities (children);
(3) Incidental ingestion of diazinon residues resulting from object to mouth activities (i.e., turf mouthing) (children);
(4) Incidental ingestion of diazinon residues resulting from soil ingestion (children);
(5) Ingestion of diazinon granules (children); and
(6) Inhalation of airborne diazinon residues (adults and children).

The post-application lawn assessment is based primarily on chemical-specific data from the turf transferable residue (TTR) Study submitted by the registrant, Novartis, in December 1999 (MRID 44959101). This study measured TTRs and air concentrations on the day of lawn treatment for both granular and liquid formulated products. This study is discussed below in more detail. Other chemical-specific studies submitted by the Registrant were reviewed and considered of insufficient quality for risk assessment (MRIDs 40204901, 42063301). In addition, HED relied on generic assumptions as specified by the newly proposed Residential SOPs (2000) and recommended approaches by HED's Exposure Science Advisory Committee (ExpoSAC) to assess children contacting recently treated turf. The SOPs use a high contact activity based on the use of Jazzercise® to represent the exposures of an actively playing child. The proposed assumptions are expected to better represent residential exposure and are still considered to be high-end, screening level assumptions. HED management has authorized the use of the revised residential SOPs that were presented to the FIFRA Scientific Advisory Panel (SAP) in September 1999. Therefore, HED has deviated from the current Residential SOP assumptions and uses the proposed assumptions to calculate exposure estimates.

The Agency is, however, currently in the process of revising its guidance for completing residential assessments. Modifications to this assessment shall be incorporated as updated guidance becomes available.

This will include expanding the scope of the residential exposure assessments by developing guidance for characterizing exposures from other sources not addressed such as from spray drift; residential residue track-in; exposures to farm worker children; and exposures to children in schools.

The exposure estimates for granular and liquid formulations are based on the maximum application rate of 4.4 lbs ai/acre and 4 lbs ai/acre, respectively. BEAD estimates that approximately 4 lb ai/acre is also the average rate for turf treatment by LCOs and in parks and other recreational areas, although the typical application rate for school playing fields is 2.4 lb ai/acre (memo from A. Halvorson, Quantitative Usage Analysis (QUA) for Diazinon, January 1, 1999).

The following chemical-specific studies were submitted by the registrant and reviewed by HED in memo from J. Cruz to B. Chambliss and C. Eiden, March 15, 2000 (D229848, D240464, D246141, and D261475):

Turf Study MRID # 449591-01

This 1999 study was conducted in response to an EPA Special Data Call In Notice (March 3, 1995, and February 1998 amendment) for Residential Re-Entry Exposure. Novartis conducted the diazinon Turf Transferable Residue (TTR) and Dissipation study in three different states; which are Georgia, California, and Pennsylvania. This study was also conducted in accordance with EPA, FIFRA Good Laboratory Practice Standards (GLP) 40 CFR Part 160 (October, 1989), and was designed to meet all the requirements of the Agency's Pesticide Assessment Guidelines, Subdivision K, Exposure, Series 132-1 (a) (Series 875-Occupational and Residential Exposure Test Guidelines, 875.2100). The test protocol template was developed by the Outdoor Residential Exposure Task Force (ORETF) for use by Task Force member companies when conducting turf transferable residue studies. The turf transferable method used in this study is called the Modified California Roller Method, which was selected by the ORETF. The two primary formulations of diazinon that are used in the residential market are the granular and the liquid. The Water-Based Concentrate (WBC) was developed to reduce the odor associated with the solvent-based emulsifiable concentrate, which is being phased out of the market place.

TTR data were collected when the turf was dry at 4, 8, 24 and 48 hours postapplication. The air samples were collected three feet above the treated turf at 0-2, 2-4 and 4-8 hour intervals. Four cloth samples, and four air samples were collected per interval per geographic location. The quality of the data were good for the TTRs, and the ambient airborne samples. The air concentrations represent aerosol and particulate levels since no vapors were detected in the 0-2 hour sampling interval. HED has requested vapor residue data from the registrant beyond 2 hours postapplication because it is likely that vapors would not be detected until the turf has dried, approximately 1-2 hours postapplication.

HED evaluated this study and has derived environmental concentrations for use in assessing postapplication exposures and risks to adults and children (1-6 yrs). Table 13 presents the TTRs, dislodgeable foliage residue, soil residue and air concentrations based on this study. The TTR and air concentrations are presented for each geographic location, and as an average across locations. The values for each location represent an average of 4 samples. The average air concentrations per time interval (0-2, 2-4 and 0-4 hours) are also presented by location. As shown on Table 13 diazinon air concentrations were below the

limit of detection following granular treatment in Georgia and California up to 4 hours after application. However, some air concentrations increased slightly in California 4-8 hours postapplication for non-irrigated granular treated turf (3 to 4 fold increase over 0-2 hour levels). In addition, the air concentrations decrease with time following liquid turf treatment, with levels either non-detectable or 2 to 10 times lower than initial concentrations by 8 hours postapplication. Generally, the air concentrations were lower for irrigated turf then for non-irrigated turf treated with the liquid or granular formulated products. For the granular treatment, two locations (Georgia and California) had non-detectable air residues for both irrigated and non-irrigated lawns up to 4 hours after treatment, while in Pennsylvania, irrigation appeared to reduce air levels to non-detectable levels. The granular labels require watering the lawn following application, although the liquid labels recommend watering the lawn either prior to treatment (for above ground pests) or following treatment (for underground pests) depending on the pest of concern.

For inhalation, HED assessed a 0-2 hour time interval because it is possible that a child or adult could enter the treated turf during or immediately after application. This is relevant for a individual that could water the lawn immediately after treatment. HED also evaluated exposures and risks associated with 2-4 hour and 0-4 hour average air concentrations to address the Registrants comments, and to provide a range of possible inhalation risk estimates that could result from turf treatment. It is likely that individuals will not be on turf treated with liquid formulations until after it has dried, which is usually 1-2 hours following application.

Turf Study MRID # 402029-01: **was only used for supplemental information** to the more recent Turf Study (MRID # 449591-01) submitted by Novartis in December of 1999, because this study had too many data discrepancies. Some examples, are: number of geographical locations was not identified; the analytical method validation (the limit of detection or the limit of quantification was not provided), field fortification data, storage stability, etc., and the time when pesticide residues were dislodged from grass clippings were not provided (the recommended time for sample analysis is within 4 hours from the time of its collection).

Turf Study MRID # 420633-01: **was only used for supplemental information** to the more recent Turf Study (MRID # 449591-01) submitted by Novartis in December of 1999, because this study also had too many data discrepancies. Some examples, are: number of geographical locations should have been for three different locations, instead of having one geographical area (Madera county, California), the analytical detection limit was set at 10 µg/sample, which should have been set at a minimum of 5 µg/sample, as in the above turf study, MRID # 449591-01; the application rate (of 4 lbs.ai/A) used in this study is lower than the most recent turf study, which was 4.4 lbs. ai/A; little information was provided regarding the physical/chemical differences between the formulations (Dyfonate 5-G/Diazinon 5-G), and no discussion was included concerning the environmental fate data for each pesticide (fonofos and diazinon); and this study did not use the Modified California Roller Method, which was selected by the ORETF. In the Modified California Roller Method the weight of the roller is critical to the amount of residues captured, the heavier the roller, the higher the residue amount. The Modified California Roller Method requires a roller weight of 32 pounds, +/- 1 pound in variation. This study utilized a roller weighing 60 kilograms (132 pounds), which means one would expect turf transferable residues (TTR) to be much higher in this study. Higher TTRs were observed in this study versus the more recent study used in this assessment.

Dermal Exposure

Dermal daily exposures (mg/kg/day) (unabsorbed) for adults and children were calculated using the following equation:

$$\text{Dermal daily dose (mg/kg/day)} = \frac{\text{TTR } (\mu g/cm^2) * \text{TC } (cm^2/hr) * 0.001 \text{ mg/}\mu g * \text{ET (hours/day)}}{\text{BW (kg)}}$$

Where,

TTR_t	=	turf transferable residue on day "t" ($\mu g/cm^2$) (based on chemical-specific data in MRID 44959101),
TC	=	transfer coefficient (cm^2/hr),
ET	=	exposure time (hr/day), and
BW	=	body weight (kg).

Hand-to-Mouth Ingestion

The daily oral dose (mg/kg/day) was calculated for children's hand-to-mouth ingestion using the following equation:

$$\text{Oral Dose}_t = \frac{DFR_t(\mu g/cm^2) \text{ x Hand SA}(cm^2/\text{event}) \text{ x SEF x Frequency (events/hr) x } 0.001 \text{ mg/}\mu g \text{ x ET (hrs/day)}}{\text{BW (kg)}}$$

Where,

DFR_t	=	dislodgeable foliage residue on day "t", or hand transfer efficiency (: g/cm^2),
Hand SA	=	hand surface area (cm^2/event),
SEF	=	saliva extraction factor (unitless),
Frequency	=	Frequency of exposure event (events/hr),
ET	=	exposure time (hr/day), and
BW	=	body weight (kg).

and

DFR_t (: g/cm^2) = Application Rate (lb ai/A) x F x $(1\text{-}D)^t$ x 4.54E+8 µg/lb x 2.47E-8 A/cm^2

Where:

DFR_t	=	dislodgeable foliage residue on day "t" ($\mu g/cm^2$),
Rate	=	application rate (lb ai/acre),
F	=	fraction of ai available for transfer to hands from foliage (unitless), and
D	=	fraction of residue that dissipates daily (unitless)

Turf Mouthing (Object to Mouth)

The daily oral dose (mg/kg/day) was calculated for children's object-to-mouth ingestion (turf mouthing) using the following equation:

$$\text{Oral Dose}_t \text{ (mg/kg/day)} = \frac{DFR_t\ (\mu g/cm^2) \times IgR(cm^2/day) \times SEF \times 0.001\ (mg/\mu g)}{BW\ (kg)}$$

Where,

DFR_t	=	dislodgeable foliage residue on day "t" or hand transfer efficiency ($\mu g/cm^2$),
IgR	=	ingestion rate of grass (cm^2/day),
SEF	=	saliva extraction factor (unitless), and
BW	=	body weight (kg)

Incidental Soil Ingestion

The daily oral dose (mg/kg/day) was calculated for incidental ingestion of soil using the following equation:

$$\text{Oral Dose}_t \text{ (mg/kg/day)} = \frac{SR_t\ (\mu g/g) \times IsR(mg/day) \times 1x10\text{-}6\ (g/\mu g)}{BW\ (kg)}$$

Where,

SR_t	=	soil residue on day "t" ($\mu g/g$),
IsR	=	ingestion rate of soil (mg/day), and
BW	=	body weight (kg).

and

$$SR_t\ (\mu g/g) = \text{Application Rate (lb ai/A)} \times (1\text{-}D)^t \times 4.54E{+}8\ \mu g/lb \times 2.47E\text{-}8\ A/cm^2 \times 0.67\ cm^3/g\ soil \times 1/cm$$

Where:

Rate	=	application rate (lb ai/acre), and
D	=	fraction of residue that dissipates daily (unitless).

The following assumptions which are based on *current* HED standard values were used to calculate dermal and oral exposures for diazinon applied to turf in the above equations:

* Application rate of 4 lb ai/acre for liquid formulated products (EPA Reg #239-2643) and application rate of 4.4 lb ai/acre for granular formulated products (EPA Reg # 239-2479), which represent both the maximum and average rates based on BEAD (QUA memo from A. Halvorson, 1-29-99).
* The turf transferable residues (TTR) were obtained from a diazinon-specific study (MRID 4459101) and used to assess dermal exposures only.
* The transfer coefficients (TC) are 14,500 and 5,200 cm^2 for adults and children, respectively based on Jazzercise data (updated assumption to Residential SOPs 2000). The TCs represent an individual wearing short pants, short sleeved shirt and occasionally footwear.
* The fraction of ai available for transfer to hands from foliage is 0.05 (5%) or the amount applied based on current HED ExpoSac Policy (minute meeting notes, 9/14/2000). The TTR value of 0.049% based on turf treatment with a liquid formulation (MRID 44959101) was not used because

the methodology used to obtain a TTR value is not appropriate for assessing "wet or sticky" hands of children, and could underestimate incidental oral exposures to children. The TTR data are designed to assess dermal exposure to pesticides using the choreographed activity Jazzercise, measured on dry cotton dosimeters, and do not address the transferability of residues by hands wetted with saliva. The 5% transfer factor is based on data by Clothier (1999). Dislodgeable foliar residue data from a 1984 California study 9MRID 40202901) based on washing grass clippings report average DFRs of 0.8% to 5.7%, depending on methodology.

* Hand surface area is 20 cm^2 which represents the mean palmar surface area of 3 fingers on a toddler (updated assumption to Residential SOPs 2000).
* The saliva extraction factor 0.5 (50%)(updated assumption to Residential SOPs 2000).
* The frequency of oral hand-to-mouth exposure events is assumed to be 20 events/hr for short-term exposure (updated assumption to Residential SOPs 2000).
* The exposure time is assumed to be 2 hrs/day. This is based on the 95^{th} percentile value (i.e., 121 minutes) for playing on grass for ages 1-4 years (Draft Residential SOPs December 18, 1997).
* The ingestion rate for grass and soil are assumed to be 25 cm^2/day (i.e., 2.x2 inches or 4 in^2) and 100 mg/day, respectively (Draft Residential SOPs December 18, 1997). The surface area of 25 cm^2 is intended to represent the approximate area from which a child may grasp a handful of grass or "mouth" an object such as a toy. HED believes this represents an upper-percentile value. The soil ingestion value is the mean soil ingestion rate for children 1-6 years.
* The body weights are assumed to be 70 and 15 kg for adults and children, respectively (Draft Residential SOPs December 18, 1997).
* The overall estimate of dermal and oral exposure represents central to high-end values.

Incidental Ingestion of Pesticide Granules

The ExpoSAC recommended that oral exposures among toddlers from incidental ingestion of pesticide granules that have been applied to lawns be calculated in addition to the oral exposure from hand-to-mouth contact. The SAC also suggested that the granular ingestion scenario be considered an individual episodic event that should not be aggregated with other non-dietary or dietary exposure scenarios. The following is a screening level assessment of oral exposure for dry pesticide materials that may be ingested by toddlers that play in treated areas. No information regarding the granular size was available. The oral dose from ingestion of granules was calculated as follows:

$$\text{Oral Dose (mg/kg/day)} = (IgR^* \times F \times CF1) / BW$$

where:

IgR	=	ingestion rate of dry pesticide formulation (g/day),
F	=	fraction of ai in dry formulation (unitless),
CF1	=	weight unit conversion factor to convert g units in the ingestion rate value to mg for the daily exposure (1,000 mg/g), and
BW	=	body weight (kg).

The following assumptions were used to estimate the daily oral dose:

* The assumed ingestion rate for dry pesticide formulations (i.e., pellets and granules) is 0.3 gram/day for children (age 3 years). This is based on the assumption that if 150 pounds of product were applied to a ½-acre lawn, the amount of product per square foot would be approximately 3 g/ft^2, and a child would consume one-tenth of the product available in a square foot. This is believed to be an upper-percentile assumption.
* Toddlers (age 3 years), used to represent the 1 to 6 year old age group, are assumed to weigh 15 kg. This is a mean of the median values for male and female children.
* Ortho® Diazinon Soil and Turf ™ (EPA Reg # 239-2479, Granular) contains 4.84 % ai. Therefore, it was assumed that F = 0.0484.
* The dose estimates generated using this method are based on some central tendency (i.e., body weight) and some upper-percentile assumptions (i.e., ingestion rate of dry pesticide formulation, and maximum application rate for short-term assessments) and are considered to be representative of high-end exposures. The uncertainties associated with this assessment stem from the use of an assumed ingestion rate of dry pesticide formulation. The dose estimates are considered to be reasonable high-end estimates.

Inhalation Exposure

The following equation was used to calculate inhalation exposure (mg/kg/day):

$$\text{Inhalation exposure (mg/kg/day)} = \frac{\text{Air Conc } (\mu g/m^3) \times \text{IR } (m^3/hr) \times \text{ET (hr/day)} \times 0.001 \text{ mg/}\mu g}{\text{BW (kg)}}$$

where,

Air Conc	=	air concentration from chemical-specific turf study (MRID 44959101),
IR	=	inhalation rate (m^3/hr),
ET	=	exposure time (hr/day), and
BW	=	body weight (kg).

The following assumptions were used to estimate the daily inhalation dose:

* The air concentrations from the chemical-specific study (MRID 44959101) for the 0-2 and 2-4 hour concentrations were evaluated, in addition to the 0-4 hour average. Both the 0-2 and 0-4 hour concentrations were evaluated to assess children that may wander onto treated lawns before they have dried.
* The hourly inhalation rate for adults of 1 m^3/hr for light activities is the value recommended by USEPA Exposure Factors Handbook, pg 5-24. For young children (1-6 years of age), a ventilation rate of 0.7m^3/hr was used. This value is based on data for play and walking activities (for children 3-5.9 years based on Adams 1993, pg 5A-3 of Exposures Factors Handbook), and also represents the average of 1 hour light activity and 1 hour of moderate activity for children ages 3-<10 years based on data from Layton 1993 (i.e., average of 0.5 m^3/hr for light activity and 1 m^3/hr for moderate activity, pg 5-16 Exposure Factors Handbook). In general, there is a paucity of ventilation data for children less than 6 years of age. One study reports ventilation rates for a 6 year old child average

0.83 m^3/hr for light activities (range 0.3 to 1.9 m^3/hr) and average 1.99 m^3/hr for moderate activities (range 1.7 to 2.6 m^3/hr), but determined these data were not appropriate to assess a 1-6 year old (pg 5A-7, of EFH). HED did not use the USEPA recommended inhalation rate of 1 m^3/hr for children (on page 5-24 of Exposure Factors Handbook) because this value is for children of all ages (infants to 18 years of age) and does not match the 15 kg child assessed in this analysis.

* The exposure time is assumed to be 2 hrs/day. This is based on the 95th percentile value (i.e., 121 minutes) for playing on grass for ages 1-4 years (Draft Residential SOPs December 18, 1997). This value could overestimate exposures for children that contact treated lawns less than 2 hours/day, but could underestimate exposures for children that play for more than 2 hours/day on treated lawns.

Table 13
Estimated Environmental Concentrations for Diazinon following Turf Treatment (MRID 44959101) (Day of Treatment) (a)

Location	Average Turf Transferable Residue (TTR) (µg / cm^2) (b)		Dislodgeable foliage residue (DFR) (Residue available for hand transfer from Grass) (µg / cm^2) (c)	Soil Residue (µg/g) (d)	Air Concentrations (µg/sample) at 1.5 L/min (e)						Average Air Concentrations (µg/m^3) (f)					
					Non-Irrigated			Irrigated			Non-Irrigated			Irrigated		
	non-irrigation	irrigation			0-2 Hr	2-4 Hr	0-4 Hr	0-2 Hr	2-4 Hr	0-4 Hr	0-2 Hr	2-4 Hr	0-4 Hr	0-2 Hr	2-4Hr	0-4 Hr
Liquid																
GA	0.0053	0.0032	2.2	30	0.092	0.077	0.084	0.071	0.069	0.07	0.509	0.428	0.469	0.394	0.383	0.389
CA	0.022	0.0049			1.02	0.36	0.691	0.296	0.077	0.187	5.652	2.055	3.836	1.644	0.428	1.089
PA	0.016	0.0033			0.87	0.275	0.573	0.188	0.213	0.2	4.836	1.535	3.178	1.044	1.183	1.11
Average	0.014	0.00382			0.66	0.237	0.449	0.185	0.12	0.152	3.66	1.34	2.49	1.03	0.665	0.85
Granular																
GA	0.0019	0.000664	2.5	33	ND (<0.1) (g)			ND (<0.1) (g)			ND (<0.578) (g)			ND (<0.578)		
CA	0.00072	0.00049			ND(<0.16)(g)			ND (<0.16) (g)			ND (<0.856) (g)			ND (<0.856)		
PA	0.0018	0.00132			0.109	0.264	0.187	ND (<0.138) (g)			0.606	1.466	1.036	ND (<0.138)		
Average	0.0012	0.000812			0.079	0.131	0.105	ND (0.132) (g)			0.441	0.728	0.585	ND (<0.132) (g)		

(a) Application rate is based on the Registrant Study, MRID #449591-01, and the labels, Ortho® concentrate, 22.4% ai, application rate = 4 lbs. ai/A), Ortho® Diazinon Soil and Turf™ (Samples were taken from the plots during three sampling time intervals on the day of appli

(b) Turf transferable residue (TTR) is from a diazinon chemical specific (Novartis) Study (MRI day of application (DAT-0), which appears to be within 1-4 hours after application, depend immediately postapplication. The Granular TTR values were collected immediately postappli

Pennsylvania.

(c) Dislodgeable Foliar Residue (ug/cm2) = Application Rate (lb ai/A) * F (Fraction ai availab noted that the highest percentage of residues available from turf, of an application rate (California).

(d) Soil concentration (ug/g) = Application Rate (lb ai/A) * 1/cm * 4.54E+8 ug/lb * 2.47E-8 A/

(e) Airborne concentrations are based on a diazinon chemical specific (Novartis) Study (MRID # from non-irrigated turf treatment over a 2-hour interval. The Registrant took samples for adjusted for the low dose field fortification recoveries of 85.8% for Georgia, 58% for Cal

(f) Air concentration ($\mu g/m^3$) = [[air sample from study (µg/sample)] / [1.5 L/min * 120 min]]

(g) Inhalation risks were not assess because all air concentrations were non-detectable.

5.2.1.2 Postapplication Residential Risk Characterization

A summary of the short-term risk estimates for residential/non-occupational postapplication exposures is presented in Table 14. As noted previously, MOEs greater than 100 do not exceed HED's level of concern for dermal and incidental oral exposure, while the target MOE is 300 for inhalation exposure.

Pathway-Specific Risk Estimates

For granular turf treatment, all adult and child residential postapplication risk estimates are greater than the target MOEs (i.e., 100 for dermal and oral and 300 for inhalation) and therefore do not exceed HED's level of concern, except for hand to mouth (MOE=3.8), granule ingestion (MOE= 0.26), and some child inhalation risk estimates from Pennsylvania. Child inhalation risk estimates based on air concentrations from non-irrigated treated turf in Pennsylvania are less than 300 for the 2-4 and 0-4 hour average air concentrations (MOEs of 190 and 270, respectively), and therefore, exceed HED's level of concern. However, no diazinon air residues were detected for granular-treated turf following irrigation, indicating that there are no inhalation risks if the lawn is irrigated (regardless of location). HED notes that diazinon was not detected in air samples in California or Georgia following granular turf treatment, and therefore, inhalation risks were not assessed.

For liquid turf treatment, all dermal and oral postapplication risk estimates are greater than 100, and therefore do not exceed HED's level of concern except the hand to mouth scenario (MOE=4.2). For non-irrigated treated turf, the inhalation MOEs for children are less than 300 (average MOE range from 76-210) depending on the time interval evaluated after turf treatment, while the adult inhalation MOE for 0-2 hour average concentration is also less than 300 (MOE=250), and therefore exceed HED's level of concern. As noted previously, the label does not require irrigation following turf treatment with a liquid formulation. Nevertheless, HED also evaluated the exposures and risks associated with irrigated liquid turf treatment to assist in risk management decisions. As shown on Table 14, with irrigation, most of the child inhalation MOEs (420-330) and all of the adult inhalation MOE (890-1400) are less than 300, and therefore, do not exceed HED's level of concern. The only irrigated MOE of concern is for children immediately after treatment (0-2 hour where MOE=270).

For inhalation, HED assessed a 0-2 hour time interval because it is possible that a child or adult could wander onto the treated turf before the turf has dried. HED also evaluated exposures and risks associated with 2-4 hour and 0-4 hour average air concentrations to provide a range of possible inhalation risk estimates that could result from turf treatment. It is likely that individuals will not be on turf treated with liquid formulations until after it has dried, which is usually 1-2 hours following application. There are uncertainties in the exposure assessments that could over- or under-estimate the risks. These uncertainties are discussed below following the presentation of aggregate risk estimates.

It is HED's policy to routinely conduct screening level assessments (based on standard values in the Residential SOPs) for children's incidental ingestion of granules when a granular pesticide may be applied in residential settings. The screening-level assessment for diazinon resulted in an MOE of 0.26 and is a risk of concern. Information on particle density (number of particles per pound or gram), carrier type (corn cob, clay), granular color, and average granular size is requested from the registrant in order to refine this screening

level assessment.

Aggregate Risk Estimates

As noted previously for residential handlers, HED estimated total risk estimates using an aggregate risk index (ARI) because of different target MOE for dermal, oral (both MOE=100) and inhalation (MOE=300) exposure routes. The target ARI is $1 (i.e., ARIs less than 1 would exceed HED's level of concern).

For the child, total risk estimates are based on the combined exposure from dermal, non-dietary (hand-to-mouth, turf mouthing, soil ingestion), and inhalation in accordance with the ExpoSac policy (meeting minutes, October 5, 2000). Ingestion of granules is not included in the ARI because this exposure is considered to be episodic. For adults only dermal and inhalation risks were combined, since oral exposures to adults are considered insignificant. The following equations were used to calculate an ARI.

$ARI = MOE_{calculated} / MOE_{acceptable}$

$ARI_{dermal+\ non\text{-}dietary\ (hand\text{-}to\text{-}mouth+turf\ mouthing+soil\ ingestion)} = MOE_{calculated\ dermal+\ non\text{-}dietary} / MOE_{acceptable\ dermal+\ non\text{-}dietary}$

$ARI_{inhalation} = MOE_{calculated\ inhalation} / MOE_{acceptable\ inhalation}$

$$AggregateRiskIndex(ARI) = \frac{1}{\frac{1}{ARI_{derm\ +\ non\ -\ dietary(children)}} + \frac{1}{ARI_{inhalation}}}$$

As shown on Table 14, the ARIs for children are less than 1, and therefore exceed HED's level of concern for both liquid and granular turf treatment, regardless of whether the 0-2 or 2-4 hour average air concentrations are used to assess inhalation risks (ARI range from 0.03 to 0.04). The ARIs are similar for granular and liquid turf treatments, and are attributed primarily to the hand to mouth risk estimates. The ARIs for adults are greater than 1, and therefore do not exceed HED's level of concern, except for the liquid turf ARI using the 0-2 hour average air concentration (ARI=0.56). The ARI for children is conservative because it assumes a child is simultaneously conducting hand to mouth activities, ingesting soil and grass, dermally contacting the treated lawn and breathing diazinon residues in air the day of lawn treatment.

HED also evaluated aggregate dermal and inhalation exposures for children to evaluate the impact of excluding the oral pathways. As shown on Table 14, most dermal and inhalation ARIs for the liquid formulation also are mostly less than 1 (ARIs range from 0.2 to 1), and therefore, exceed HED's level of concern. However, the ARIs for non-irrigated granular turf treatment are mostly greater than 1 (ARIs range from 0.59 to 5), and therefore, do not exceed HED's level of concern. The exception is Pennsylvania, where the combined dermal and inhalation risks (for 2-4 hour average concentration) for a child result in an ARI of 0.59.

Uncertainties

There are uncertainties in the inhalation MOEs that could over- or under-estimate the risks. For example, the most important factors that contribute to the possible over-estimation of risk are:

(1) use of a 21 day inhalation toxicity endpoint based on whole body exposure in rats to assess a 2 hour exposure scenario;
(2) use of a 21 day rabbit dermal toxicity endpoint to assess a 2 hour exposure scenario;
(3) assumption that individuals contact treated turf for 2 hours the day of treatment (after the turf has dried for dermal and oral pathways), or inhale the volatilized residues immediately after treatment for inhalation (i.e., 0-4 hours post application). ORETF survey data shows that 84% of the population waits at least 2 hours and 66% of the population waits at least 12 hours to enter treated turf;
(4) use of an inhalation rate of 0.7 m^3/hr for children less than 3 years of age, when there are few data available on this parameter;
(5) assuming that children play on treated lawns 2 hours the day of treatment, which could overestimate risks to children that are on treated lawns less than 2 hours. This value is based on the 95th percentile value (i.e., 121 minutes) for playing on grass for ages 1-4 years (Draft Residential SOPs December 18, 1997); and
(6) use of one-half the detection limit for non-detectable residues in air measurements.

The most important factors that contribute to the possible under-estimation of risk are:

(1) This assessment does not assess potential exposures to all environmental metabolites, including diazoxon, which may form in the presence of chlorination (i.e., watering lawn with chlorinated water may enhance formation of diazoxon);
(2) The inhalation risk estimates are based on aerosol exposure only and do not account for possible vapor concentrations that could be present once the turf has dried (i.e., the registrant study did not provide vapor residue data beyond 2 hours postapplication, and these data have been requested from the registrant).
(3) Use of average air concentrations across three geographic locations, when two of the three locations (California and Pennsylvania) treated with the liquid formulations had higher average air levels (up to 1.5 times higher) four hours after turf treatment then the geographic average;
(4) use of a child inhalation rate of 0.7 m^3/hr for children, which could underestimate exposure and risks to children 6 years of age and older involved in moderate activities such as playing baseball, soccer, etc for more than 1 hour the day of treatment. There are data that report average inhalation rates for a 6 year old child of 0.83 m^3/hr for light activities and 1.99 m^3/hr for moderate activities (p. 5A-7 of Exposure Factors Handbook, USEPA 1997); and
(5) assuming that children play on treated lawns 2 hours the day of treatment, which could underestimate risks to children that are on treated lawns more than 2 hours.

It should be noted that the diazinon air residues declined substantially (2-10 fold of initial air levels) within 8 hours of turf treatment for liquid formulation. In addition, the turf transferable residues dissipated rapidly over time, with residues non-detectable within 2 days postapplication. Therefore, the exposure and risk estimates

on day 2 postapplication would be significantly less than the day of treatment exposure and risk estimates presented in this assessment.

In addition, the Residential SOPs are considered to be conservative scenarios for determining risk estimates. The adult and toddler transfer coefficients are based on the Jazzercise protocol and an upper percentile exposure duration value. The dermal exposure estimates, however, are more refined because they are based on actual TTR data compared to the incidental ingestion scenarios which are based on estimated grass and soil concentrations, and dislodgeable foliage residues (DFR) (based on 5% of the application rate is transferable to a child's wet hand based on Clothier 1999).

Mitigation measures for residential exposure to diazinon residues may include the watering-in of both liquid and granular formulations on turf. There is some evidence from the Novartis study data submitted that watering increases the residue dissipation rate, and decreases the air concentrations. Turf labels require watering for granular formulations, but recommend watering prior to or following liquid turf treatment depending on the pest concern. This instruction, however, does not prevent contact with turf prior to watering-in.

Table 14
Summary of Dose Estimates and Margins of Exposure for Postapplication Exposures on Treated Turf (Day of Treatment)
(MRID 44959101)

Scenario	Time after Treatment	Central Tendency Dose (mg/kg/day)				Central Tendency MOE (Range) (a)			
		Adult		Child		Adult		Child	
		non-irrigated	irrigated	non-irrigated	irrigated	non-irrigated	irrigated	non-irrigated	irrigated
Liquid Formulation									
Dermal	1-2 hour (when turf dry for non-irrigation); 4 hours (irrigation)	0.0058 (b)	0.0016 (b)	0.0097 (b)	0.0026 (b)	170 (110-460)	630 (490-750)	100 (66-270)	380 (290-450)
Hand to Mouth		NE		0.0598 (c)		NE		**4.2**	
Turf Mouthing (object to mouth)		NE		0.00187 (d)		NE		130	
Soil Ingestion		NE		0.0002 (e)		NE		1200	
Inhalation (f)	0-2 hr	0.0001	0.00003	0.00034	0.000096	**250 (160-1800)**	890 (550-2300)	**76 (49-550)**	**270 (170-710)**
	2-4 hr	0.000038	0.000019	0.00012	0.000062	690 (460-2100)	1400 (770-2400)	**210 (140-650)**	420 (240-730)
	0-4 Hr	0.000071	0.000024	0.00023	0.000079	370 (240-1950)	1100 (820-2300)	**110 (73-600)**	330 (250-720)
Total Aggregate Risk Index (ARI) (h)								**0.03 (0-2 hr inh) 0.04 (2-4 hr inh)**	**0.04 (0-2 hr inh) 0.04 (2-4 hr inh)**
Dermal and Inhalation Aggregate Risk						**0.56 (0-2 hr inh)** 1 (2-4 hr inh)	1 (0-2 hr inh) 1.24 (2-4 hr inh)	**0.2 (0-2 hr inh) 0.42 (2-4 hr inh)**	**0.73 (0-2 hr inh)** 1 (2-4 hr inh)
Granular Formulation									

Table 14
Summary of Dose Estimates and Margins of Exposure for Postapplication Exposures on Treated Turf (Day of Treatment)
(MRID 44959101)

Scenario	Time after Treatment	Central Tendency Dose (mg/kg/day)				Central Tendency MOE (Range) (a)			
		Adult		Child		Adult		Child	
		non-irrigated	irrigated	non-irrigated	irrigated	non-irrigated	irrigated	non-irrigated	irrigated
Dermal	1-2 hour (when turf dry for non-irrigation); 4 hours (irrigation)	0.0005 (b)	0.0003 (b)	0.0009 (b)	0.0006 (b)	2000 (1300-3400)	3000 (1800-5400)	1200 (760-2000)	1800 (1100-3200)
Hand to Mouth		NE		0.066 (c)		NE		**3.8**	
Turf Mouthing (object to mouth)		NE		0.00206 (d)		NE		120	
Soil Ingestion		NE		0.00022 (e)		NE		1100	
Granule Ingestion		NE		0.97 (g)		NE		**0.26**	
Inhalation (f)	0-2 hr	0.0000017 (PA)	Not detected (ND)	0.000057 (PA)	Not detected (ND)	1500-PA ND--CA and GA	Not detected (ND)	460–PA ND–CA and GA	Not detected (ND)
	2-4 hr	0.000042 (PA)		0.000136 (PA)		620--PA ND--CA and GA		**190**–PA ND–CA and GA	
	0-4 Hr	0.00003 (PA)		0.000096 (PA)		880--PA ND--CA and GA		**270**–PA ND–CA and GA	
Total Aggregate Risk Index (ARI) (h)								**0.04**	**0.04**
Dermal and Inhalation Aggregate						5 (0-2 hr inh) 2 (2-4 hr inh) (PA only)	Not applicable (no inhalation risk)	1.3 (0-2 hr inh) **0.59** (2-4 hr inh) (PA only)	Not applicable (no inhalation risk)

(a) MOE = NOAEL / Exposure, where short-term dermal NOAEL is 1 mg/kg/day from a dermal study, the short-term oral NOAEL is 0.25 mg/kg/day from an oral toxicity study and the short-term inhalation LOAEL = 0.026 mg/kg/day from an inhalation study. Values represent an average of all data from the diazinon turf study, the range represents MOEs from the three different locations (CA, GA and PA) for which data are available. **Target MOE = 100 for dermal and oral and 300 for inhalation. Target ARI $ 1.**

(b) Dermal Dose (unabsorbed) (mg/kg/day) = TTR (µg/cm^2) * TC * 0.001 mg/ug * 2 hr/day / body weight, where adult and child body weights are 70 and 15 kg, respectively, and TC are 14,500 and 5,200 cm^2/hr for adults and children, respectively.

(c) Hand-to-mouth (mg/kg/day) = DFR (µg/cm^2) * 20 events/hour * 20 cm^2/event * 0.5 (50% saliva extraction factor) * 2 hour/day * 0.001 mg/µg/ 15 kg.

(d) Turf mouthing (mg/kg/day)=DFR (µg/cm^2)*25 cm^2 /day*0.5(50 % saliva extraction factor)*0.001mg/µg/15 kg

(e) Soil ingestion (mg/kg/day) = soil residue µg/g * 100 mg/day * 1x10-6 g/µg / 15 kg.

(f) Inhalation Dose (mg/kg/day) = [air concentration (µg/m3) * inhalation rate (m3/hr)*0.001 mg/µg * 2 hour] / body weight of 15 kg or 70 kg. Air concentration is the average across geographic locations for liquid formulation. For granular formulation, only Pennsylvania was evaluated because air concentrations were non-detectable in California and Georgia for non-irrigated turf treatment. Adult inhalation rate is 1 m3/hr based on light activities USEPA p. 5-24 Exposure Factors Handbook. Child inhalation rate is 0.7 m3/hr based on play activities for 3-6 yr old children from Adams 1993, Exposure Factors Handbook pg. 5A-3, which is also the average of 1 hour light activities at 0.5 m3/hr and 1 hour of moderate activities based on data from Layton 1993, pg.5-16 for children 3-< 10 years. One-half non-detected value was used to assess exposure and risk for some scenarios, in accordance with HED policy.

(g) Ingestion of granules (mg/kg/day) = 0.3 g/day * 0.0484 (% ai) * 1000 mg/g / 15 kg.

(h) Aggregate Risk index (ARI) = sum of oral, dermal and inhalation exposures, except for granule ingestion which is considered to be episodic for children, and sum of dermal and inhalation for adults. ARI calculated based on both 0-2 hour and 2-4 hour inhalation MOEs.

5.2.2 Indoor Use

5.2.2.1 Postapplication Exposure Data and Assumptions

Diazinon is currently registered for indoor use for carpet treatments, and crack and crevice treatments. In addition, it is registered for use in pet collars. Adult and toddler exposures were assessed. Toddlers are the subgroup with the highest potential exposures. All crack and crevice treatments are expected to result in short-term (1-7 day) exposures through inhalation of airborne diazinon for both children and adults. In addition, children are expected to have direct dermal exposures associated with crawling, and oral exposures through hand-to-mouth activities. Pet collar exposures are considered potentially long-term, as each collar is effective approximately 5 months, and it was assumed that old collars are replaced by new collars.

5.2.2.1.1 Crack and Crevice Treatments

The registrant has recently decided (July 2000) not to support indoor uses of diazinon. This includes use inside any structure or vehicle, vessel, or aircraft and/or on any contents therein, as noted previously in this document. The registrant submitted several studies that assessed residential post-application exposures. However, only one indoor study was of sufficient quality to use in risk assessment (MRID No. 443488-01). These studies are reviewed memo from J. Cruz to B. Chambliss and C. Eiden, March 15, 2000 (D229848, D240464, D246141, D261475).

MRID Nos. 443488-01, and -06

MRID #443488-01

This report reviews exposure assessments submitted by Novartis Crop Protection, Inc. (formerly Ciba Crop Protection, Ciba-Geigy Corporation) to US-EPA. Novartis assesses applicator exposure and residential post application exposure resulting from the indoor uses of the organophosphate insecticide diazinon. The Novartis report **does not contain raw data, rather it presents exposure calculations based on other studies**, only some of which have been published in the open literature.

The author begins by reviewing a list of eleven diazinon products registered to Novartis for use in and around residences and offices, containing from 0.5% to 56% a.i. diazinon. Of the eleven products listed, only one seems to have been used in the studies on which the assessments rely. This product was D-z-n® Diazinon 4E, which is an emulsifiable concentrate (i.e. 4 lb a.i./gallon, or 47.5% a.i.). Next, the author reviews various use pattern data from California Department of Pesticide Regulation (CDPR, 1993), EPA's National Home & Garden Pesticide Use Survey (NHGPUS, 1992), and a report on professional lawn care pesticide usage ("Professional Markets for Pesticides and Fertilizers, the "Kline Report," 1993).

Relevant findings included:

CDPR reported that PCOs applied diazinon most frequently for structural pest control (22,473 applications that year), handling an average of 12.9 lbs a.i./application;

- EPA's one-time survey of homeowner pesticide usage found that diazinon was most frequently applied outdoors by the general public. About 15% of households reported using diazinon. Of those, approximately 23% of all applications were made indoors, most commonly to the kitchen.

Post-application inhalation exposures for adult and toddler residents were estimated using three indoor air studies, the model SCIES, and EPA's Non-occupational Pesticide Exposure Study (NOPES, 1993). Amounts of diazinon applied were much lower in the three indoor air monitoring studies (between 1.8 and 11.3 grams ai applied) than postulated for the occupational exposure assessment (i.e. 12.9 pounds ai applied).

- Measured and modeled peak indoor air concentrations were all similar, ranging from 4.65 to 87 $\mu g/m^3$.

- Based on the average indoor air level found in three air monitoring studies over the first 24 hours after application, daily adult inhalation exposure on the first day after application was estimated to be 8.2 µg/kg/day. Daily toddler inhalation exposure on the first day after application was estimated to be 21.9 µg/kg/day.

- Based on the average indoor air (personal samples) level found in Florida (e.g. high-use location, seasonal peak), daily adult inhalation exposure on the first day after application was estimated to be 0.069 µg/kg/day. Daily toddler inhalation exposure on the first day after application was estimated to be 0.19 µg/kg/day. [The average value used ranked at the 75^{th} percentile among measurements made.]

Overall, the rationale used to present the inhalation (dermal exposure was not monitored nor assessed) exposures for both the Applicator and for Post Application was reasonable. The following issues and concerns were identified, however:

- The reviewers note that the exposure estimates presented may not be directly comparable since different (or unknown) quantities of diazinon may have been applied. Two Novartis indoor air monitoring studies applied 11.3 and 10 grams ai/day (the SCIES modeling run assumed 11.3 grams ai/day applied). A third indoor air study applied only 1.9 grams ai/day. Amounts applied in the NOPES and the Hayes (bio-monitoring) studies were not reported.

- **The quality of the data reported from the three indoor air monitoring studies is not known** The reviewers could not determine whether the studies complied with OPPTS 875 guidelines. For most of the studies, it is unknown whether, for example, raw data were corrected for field fortified or laboratory recoveries.

- Several typographical errors were noted. Peak post-application indoor air values are variously reported as 54 µg/m^3 or 60 µg/m^3. Daily inhalation exposure to adults and toddlers were reported as 8.9 µg/kg/day and 24 µg/kg/day, respectively, however, on page 33 of the Study Report, these exposure values were reported as 8.2 µg/kg/day for adults and 21.9 µg/kg/day for toddlers.

Previously, in 1996, the Agency granted a waiver for indoor residential dermal post-application exposure data. However, in light of FQPA, the data waiver previously granted for indoor residential dermal post-application exposure data is no longer applicable. The registrant needs to provide quality chemical specific (diazinon) indoor residential dermal and inhalation post-application exposure study data (per Series 875.2400); in order to refine post-application exposure estimates. Table 15, below, summarizes the exposure estimates presented by the author in the Novartis study.

Table 15
Summary of Novartis Diazinon Indoor Exposure Assessment Information

Source	Post-Application, Indoor Inhalation Exposure			USEPA Estimated MOE (b)
	Peak Air Conc'n	Adult	Toddler	
Novartis, 1980 Indoor air monitoring after whole house crack & crevice treatment - 11.3 grams ai	55 µg/m^3	8.2 µg/kg/day (a) (Avg= 37.8 µg/m^3 from all 3 studies for 0-24 hour)	21.9 µg/kg/day (a) (All 3 studies' Avg.)	Adult: 3.2 Child: 1.2 (MOEs based on avg of all three studies for 0-24 hr)
Novartis, 1981 Indoor air monitoring after whole house crack & crevice treatment - 10 grams ai	87 µg/m^3 (during appl'n)			

Table 15 Summary of Novartis Diazinon Indoor Exposure Assessment Information				
Source	**Post-Application, Indoor Inhalation Exposure**			**USEPA Estimated MOE (b)**
	Peak Air Conc'n	**Adult**	**Toddler**	
North Carolina State University, Wright & Leidy, 1982 Indoor air monitoring after dorm room application - 1.9 grams ai	38 ∶g/m^3			
SCIES Model Indoor air monitoring after kitchen crack & crevice treatment - 11.3 grams ai assumed	18 ∶g/m^3	---	—	
NOPES Survey Jacksonville, FL - summer Ambient Air samples	13.7 ∶g/m^3 (0.42 ∶g/m^3 was the arithmetic mean)	---	---	
NOPES Survey Jacksonville, FL - summer Personal Samples	4.65 ∶g/m^3 (0.32 ∶g/m^3 was the arithmetic mean)	0.069 ∶g/kg/day (mean) 0.41 ∶g/kg/day (95th percentile) (NOPES only; based on mean)	0.19 ∶g/kg/day (mean) 1 ∶g/kg/day (95th percentile) (NOPES only; based on mean)	Adult: 380 (mean) 63 (95th percentile) Child: 140 (mean) 26 (95th percentile)

(a). "Maximum inhalation exposure" is based on an average indoor air concentration of 37.8 ∶g/m^3 over the first 24 hours after diazinon application (three studies; N=6 data points at time=0 and time = 24 hours, two data points from each study); inhalation rate of 15.2 m^3/day for an adult, and 8.7 m^3/day for a toddler; body weights 70 kg for an adult and 15 kg for a toddler.

(b) Margin of Exposure (MOE) = inhalation LOAEL of 0.026 mg/kg/day / Daily inhalation dose. The target MOE = 300, which does not exceed HED's level of concern.

Post Application Indoor Air Concentration Study Conclusions

The peak or maximum air levels of diazinon monitored in the Novartis and North Carolina State University studies and predicted by SCIES were similar. Table 16, below, provides a comparison between the three studies and the SCIES predicted values. The average post application air concentrations of diazinon predicted by SCIES are much lower than measured concentrations in the Novartis and North Carolina State University

diazinon studies. The SCIES model is expected to predict a lower average concentration than the actual measured concentrations. The SCIES model is based on diazinon application only in the kitchen rather than in the entire house, as in the Novartis study or one small enclosed room as in the North Carolina State University study. The SCIES model also assumes that the homeowner was out of the house for three hours during the day.

Table 16
Comparison of Diazinon Indoor Air Monitoring Study Results and Modeling Results

Parameters	1980 Novartis Study	1981 Novartis Study	North Carolina State University Study	Studies Averaged	SCIES (predicted)
Maximum Air Concentrations	55 µg/m^3	69 µg/m^3	38 µg/m^3	54 µg/m^3	18 µg/m^3
Average Post Application Air Concentrations	24 µg/m^3 (24 hours)	11 µg/m^3 (24 hours)	30 µg/m^3 (24 hours)	22 µg/m^3	0.20 µg/m^3 (day of application)
Application Zone (size of room)	Entire house (size not provided)	Entire house (size not provided)	Small room (Dorm-45.1 m^3)	N/A	Kitchen only (20.0 m^3)

Note: SCIES considers an entire house's volume = 408 m^3

The NOPES data provides a profile of general population exposure to diazinon indoor air levels. The NOPES data indicates the impact of diazinon use levels on indoor air concentrations. Air concentrations in both cities dropped markedly during the winter when insecticide use was minimal. In geographical areas such as Springfield, MA, where insect infestation is not a major problem, the air concentrations of diazinon are very low, below the limit of detection at the 75th percentile of the population. The mean indoor air concentration in the spring within Springfield, MA was 0.048 µg/m^3 (at or greater than the 95 percentile) compared to the Jacksonville mean indoor air concentration in the summer (**season of highest diazinon use** within Jacksonville) of 0.42 µg/m^3 (between the 75 and the 90 percentiles; at the 95 percentile- airborne level concentrations are equal to 2.2 µg/m^3). The Jacksonville NOPES data are reflective of indoor air concentrations in homes where insect problems are great and where diazinon is used for insect control, **except** in northern areas during the winter months (e.g. Chicago and New York project areas). It is highly probable that in geographical northern areas during the winter months that residents would tend to keep windows and doors closed due to the environmental temperatures and high crime rates in these areas. Therefore it is expected that inhalation exposure values for high infested areas, where diazinon is used for insect control in the North during the winter months would be higher than the reported Jacksonville inhalation exposure levels. During the monitoring period of highest concentration (summer) the average air concentration measured on the personal air samplers was 0.32 µg/m^3- slightly above the 75th percentile, and 1.9 µg/m^3 at the 95th percentile (in Jacksonville). The SCIES model predicted the average air concentration for a homeowner to be 0.12 µg/m^3. NOPES Jacksonville air concentrations measured with the personal air samplers account for individual activity patterns as does the SCIES model. The maximum diazinon air concentration monitored in the NOPES

study was 13.7 µg/m^3 which is almost identical to the SCIES predicted peak air concentrations of 18 µg/m^3 and ranges from 20% to 36% of the maximum post application air concentrations of 38, 55, and 69 µg/m^3 measured in the Novartis and air monitoring studies.

Estimation of Post Application Diazinon Indoor Inhalation Exposure

Table 17, below, presents the daily indoor inhalation exposure results calculated using the results from the monitoring studies. According to these monitoring studies, the greatest potential for post application inhalation exposure to diazinon occurs during the 24 hours following the indoor application of diazinon. Based on the monitoring data from the three studies, at time 0 and 24 hours, an average indoor air concentration of 37.8 µg/m^3 {[(0.55+0.024-Novartis-1980) +(0.069 +0.011-Novartis-1981) + (0.038 +0.030 -North Carolina State Univ.)] / 6 = 37.8 µg/m^3} was used as the indoor air concentration of diazinon during the first 24 hours after indoor application. The Agency default daily inhalation volume of 15.2 m^3/day for an adult was used to estimate the daily inhaled dose. Based on a 70 kg body weight, the daily inhaled dose of diazinon during the 24 hours following indoor application was calculated. The equations used were provided on page 33 of the Study Report. The daily adult inhalation exposure-first 24 hours post application was 8.2 µg/kg/day. The daily toddler inhalation exposure-first 24 hours post application using 15 kg for body weight and 8.7 m^3/day inhalation volume (Agency default) was calculated to be 21.9 µg/kg/day.

Using the NOPES Jacksonville summertime **average** indoor air concentration of 0.32 µg/m^3 (95th percentile = 1.9 µg/m^3) , which represents a reasonable upper-bound estimate for this geographical area of diazinon air concentration after the initial application. The daily adult inhalation exposure was calculated to be 0.069 µg/kg/day and the daily toddler inhalation exposure was calculated to be 0.19 µg/kg/day.

Table 17
Post Application Diazinon Indoor House Inhalation Exposures

Source of Exposure Calculations	Air Concentration µg/m^3	Dose Daily Results mg/kg/day		MOEs[1]	
		Adult	Child	Adult	Child
24-Hour average postapplication value from Novartis 1980, 1981 and Wright and Leidy 1982	37.8 µg/m^3 (mean)	0.0082	0.022	3.2	1.2
NOPES -Daily Inhalation Exposure (for the mean and the 95th percentile)	0.32 (mean)	0.000069	0.00019	380	140
	1.9 (95th percentile)	0.00041	0.001	63	26

[1] = Margin Of Exposure (MOE) = Inhalation (for all time frequencies) LOAEL (0.026 mg/kg/day)/Daily Inhalation Dose. *The **Inhalation Target MOE = 300; which does not exceed HED's level of concern.***

The registrant did not address dermal exposure during this study; Data from several sources were examined to complete dermal exposure risk assessments. The data for dermal exposures were obtained from the following sources: the inhalation exposure data (lbs/gms ai applied) in this registrant's study, the current registrant's label-4E's application rate, current real-estate information (e.g. room sizes within houses, built around 1961 to 1999), and other information (e.g. Tc, events/hr, surface area, etc.) from the Revised SOPs Residential Exposure Assessments Guide. Table 18, below, summarizes the dermal exposure, dose, MOE estimates presented by the Agency (Reviewer).

Table 18
Summary of Diazinon Indoor Post-application Short-Term Dermal Exposure Assessment Information
(Based on Novartis's post-application inhalation data)

Source (4E-Label) [1]	Application Rate		Area ($ft.^2$) (i)	Indoor Surface Residue ($\mu g/cm^2$) (l)	Dose (mg/kg/day) (m)		MOE (n)	
	Lbs.	gms.			Adult	Toddler	Adult	Toddler
EPA Reg# 100-463 @ 1%, 1.3 liters (a)	0.026	11.8	Kitchen 40.5 (j)	15.7 (hard surfaces)	15	25	0.068	0.04
EPA Reg# 100-463 @ 1%, 1.3 liters (b)	0.026	11.8	Kitchen 40.5 (j)	15.7 (o) (I0% skin contact of hard surfaces)	1.5	2.5	0.68	0.4
EPA Reg# 100-463 @ 0.5%, 1.3 liters (c)	0.013	5.9	Kitchen 40.5 (j)	7.8 (hard surfaces)	7.5	12	0.13	0.084
EPA Reg# 100-463 @ 0.5%, 1.3 liters (d)	0.013	5.9	Kitchen 40.5 (j)	7.8 (o) (I0% skin contact of hard surfaces)	0.75	1.2	1.3	0.8
EPA Reg# 100-463 @ 0.5%, 1-gal (e)	0.039	17.7	House 189 (k)	2.6 (carpet surfaces)	5	8.3	0.2	0.12
EPA Reg# 100-463 @ 0.5%, 1-gal (f)	0.039	17.7	House 189 (k)	2.6 (o) (25% skin contact of carpet surfaces)	1.2	2.1	0.84	0.48
EPA Reg# 100-463 @ 0.25%, 1-gal (g)	0.02	8.9	House 189 (k)	1.3 (carpet surfaces)	2.5	4.2	0.4	0.24
EPA Reg# 100-463 @ 0.25%, 1-gal (h)	0.02	8.9	House 189 (k)	1.3 (o) (25% skin contact of carpet surfaces)	0.62	1	1.6	1

[1] = This label was used in the registrant's Study, MRID 443488-01.

(a) This concentration, and amount was approximately used in this study. The predominant area that was treated was in the kitchen (hard surfaces), and air sampling pumps were placed in the kitchen to collect the inhalation exposure data; therefore this dermal exposure/dose corresponds to the inhalation exposure recorded within this study report [see table 12 (a), above (Novartis-1980) for the corresponding average inhalation exposure from three studies (Novartis-1980, Novartis-1981, & North Carolina State University), and table 12(c), for their corresponding dose and MOE].

(b) The same information in foot note [a] above applies, except for assuming only 10 % dermal contact of hard surfaces with residents.

(C) The same information in foot note [a] above applies, except for the concentration; which has been reduced by half to 0.5%.

(d) The same information in foot note [a] above applies, except for assuming only 10 % dermal contact of hard surfaces with residents and the concentration; which has been reduced by half to 0.5%.

(e) This concentration and amount is typical for minor to moderate infestations of insects for an entire house's main living areas, see

footnote 2[b], for details of which areas.

(f) This concentration and amount is typical for minor to moderate infestations of insects for an entire house's main living areas (see footnote 2[b], for details of which areas), except for assuming only 25 % dermal contact of carpet surfaces.

(g) This concentration and amount is typical for minor (pest free maintenance) infestations of insects for an entire house's carpeted main living areas (see footnote 2[b], for details of which areas).

(h) This concentration and amount is typical for minor (pest free maintenance) infestations of insects for an entire house's carpeted main living areas (see footnote 2[b], for details of which areas), except for assuming only 25 % dermal contact of treated carpet surfaces.

(i) The registrant's study, MRID # 443488-01, did not provide the square footage that was treated by the PCO in both North Carolina studies of 1980 & 1981; nor the area of the kitchens or houses where these studies took place.

(j) For Crack & Crevice application, the average square footage was obtained from real estate data of 6-7 houses, built in 1961 - 1999 and the treated base-board's footage. First, the average estimated potential treated perimeter was determined, for the kitchen; which is: Kitchen = 54 ft. [(14 x 2) + (13 X 2)]. And two, the estimated potential treated base-board footage was determined by assuming the base-board's height is 3.5 inches tall, 2 inches above it and then 3.5 inches out from the wall = 9 inches in all = 0.75ft. The total area treated of the kitchen was determined by taking the total linear feet by the estimated potential treated base-board's footage = 40.5 ft^2 .

(k) For Crack & Crevice application, the average square footage was obtained from real estate data of 6-7 houses, built in 1961 - 1999 and the treated base-board's footage. First, the average estimated potential treated perimeters were determined, and are as follows: Living Rm. = 60 ft. [(17 x 2) + (13 X 2)]; Dining Rm. = 44 ft. [(12 x 2) + (10 X 2)]; Master Bed Rm. = 54 ft. [(15 x 2) + (12 X 2)]; Bed Rm.-2 = 48 ft. [(13 x 2) + (11 X 2)]; and Bed Rm.-3 = 46 ft. [(13 x 2) + (10 X 2)] = total linear feet of 252. And two, the treated base-board footage was determined by the same method as in foot note 2[a]. The treated total area of the house was determined by taking the total linear feet by the estimated potential treated base-board's footage = 189 ft^2 .
Only the carpeted main living areas were considered; such as bed rooms, living rooms, and dining rooms, as a screening level to estimate what dermal exposures/does could be. Hallways, closets, basements, and utility areas were not considered at this time.

(l) Indoor Surface Residue (ISR-µg/cm^2) = [(lbs. ai / square footage area treated) X (50% of potential maximum ai concentration available from crack & crevice treatment) X (% of Indoor surface transferable residues- 5% for carpets, and - 10% for hard surfaces) X (Conversion factor- 4.54 X 10^8 µg/ lbs) X (Conversion Factor- 1.08 X 10^{-3} ft^2 / cm^2)].

(m) Dose = [ISR X (Conversion factor- 0.001 mg/µg) X (Transfer Coefficient-Tc, for adults = 16,700 cm^2/hr, and for toddlers = 6,000 cm^2/hr) X (Duration, for hard surfaces-4hours, and carpet surfaces-8hours)] / BW, for adults = 70 kg, and for toddlers = 15 kg.

(n) MOE = Short-term Dermal NOAEL (1 mg/kg/day) / Dermal Dose (mg/kg/day).

(o) For only 10% dermal contact of treated surfaces, reduce the Tc by 0.1. For only 25% dermal contact of treated surfaces, reduce the Tc by 0.25.

MRID #443488-06

This study titled, Risk Assessment For Indoor Diazinon Uses, does not provide any chemical specific data for diazinon. This study is based on an evaluation of potential risk associated with applicator exposure and post-application exposure resulting from the indoor residential and greenhouse uses of diazinon.

5.2.2.1.2 Pet Collars

Several flea pet collar products are marketed containing diazinon as the active ingredient. HED has no chemical-specific data addressing the exposures of individuals from the use of pet flea collar products. In lieu of such data, it is necessary to estimate exposures from this scenario using HED's Residential SOP. The SOPs specify that in the absence of actual field data, "one percent (0.01) of the active ingredient applied to the pet be available for dermal exposure from handling flea collars. This assumption is based on the best professional judgement of the OPP/HED staff and assumed to be an upper-percentile value." Additionally, adults are assumed to weight 70 kg and infants and children were assumed to weigh 15 kg. The estimated exposures and MOEs for each typical pet collar products for adults and children are presented on Table 19.

Table 19 Dermal Exposure and Risk Estimates from Diazinon Pet Collar Products								
Product Registration	**Weight of Flea Collar (g)**	**Percent Active Ingredient**	**Grams of Diazinon in Product**	**Total mg of Exposure (i.e., 1% of product)**	**Exposure (mg/kg/day) (a)**		**MOE (b) (Target$300)**	
					Adult	**Child**	**Adult**	**Child**
EPA No. 2517-24	45	11	5	50	0.0048	0.022	210	45
EPA No. 2517-25	20	11	2.2	22	0.0021	0.0097	480	100
EPA No. 2517-29	12.2	15	1.8	18	0.0017	0.0081	590	120
EPA No. 2517-30	23	15	3.5	35	0.0033	0.015	300	66

(a) The Residential SOP were used (i.e., assumed 1% of the ai was available for dermal exposure) to estimate the total amount of diazinon available for exposure. Available residues were amortized over use time assuming linear dissipation. Exposure=total mg exposure / days of use / BW.

(b) MOE=NOAEL/exposure, where the NOAEL is 1 mg/kg/day from a 21-day dermal rabbit study. This endpoint was identified for intermediate and long-term dermal risk assessment with a **Target MOE=300**.

5.2.2.2 Residential Postapplication Risk Characterization

5.2.2.2.1 Crack and Crevice Treatments

Inhalation exposure resulting from PCO'S indoor applications of diazinon based on US EPA's Screening Level Consumer Inhalation Exposure Software (SCIES) model and the Non-occupational Pesticide Exposure Study (NOPES). Based on the monitoring data from three monitoring studies, an average indoor air concentration of 38 : g/m^3 represents the indoor air concentration of diazinon during the first 24 hours after indoor application. The registrant assumes an inhalation absorption correction factor of 100 % . In this risk assessment (MRID No. 443488-01), the registrant also used a different Inhalation NOAEL of 2.5 mg/kg/day from the acute oral study of Meyer, 1997 (the Agency's Inhalation LOAEL is 0.026 mg/kg/day, for all time frequencies). The registrant's calculated inhalation dose for a body weight of 70kg, an average breathing volume of 15.2 m^3/day, and an average air concentration of 38 : g/m^3, is calculated as follows: [(15.2 m^3/day * 38 : g/m^3)/ 70kg] = 8.5 : g/kg/day for an adult. For a toddler, maximum inhalation exposure during the first 24 hours after application is calculated as follows: [(8.5 m^3/day * 38 : g/m^3)/ 15kg] = 22 : g/kg/day. Novartis estimates corresponding MOEs of 290 and 110 for adults and children, respectively (Target MOE=300). As shown on Table 17, HED estimated inhalation MOEs of 1.2 to 140 for children and 3.2 to 380 for adults based on an evaluation of registrant submitted study (MRID 44348801). All MOEs are of concern (i.e., less than 300), except for the adult MOE of 380 based on the mean data from the NOPES survey.

Dermal exposure was not assessed by the registrant. Therefore, HED estimated dermal exposures based on

data from MRID 443488-01 and assumptions from the Draft Residential SOPs, and updated SOPs. As shown previously on Table 18, the dermal MOEs are less than 2 for both adults and children, and therefore exceed HED's level of concern (target MOE=100).

5.2.2.2.2 Pet Collars

As shown on Table 19, the intermediate and long-term dermal MOEs for children range from 66 to 120 and therefore, exceed HED's level of concern (target MOE of 300). The adult MOEs are greater than or equal to 300, for three collar products (MOEs range from 300 to 590), but are below 300 for one product (MOE=210). These risk estimates are considered high-end because they are based on screening methodology proposed in the Residential SOPs. Additional data on available transferable residues would help refine these exposure and risk estimates.

5.3 Exposure and Risk from Spray Drift

Spray drift is always a potential source of exposure to residents nearby to spraying operations. This is particularly the case with aerial application, but, to a lesser extent, could also be a potential source of exposure from the ground application method employed for diazinon. The Agency has been working with the Spray Drift Task Force, EPA Regional Offices and State Lead Agencies for pesticide regulation and other parties to develop the best spray drift management practices. The Agency is now requiring interim mitigation measures for aerial applications that must be placed on product labels/labeling. The Agency has completed its evaluation of the new data base submitted by the Spray Drift Task Force, a membership of U.S. pesticide registrants, and is developing a policy on how to appropriately apply the data and the AgDRIFT computer model to its risk assessments for pesticides applied by air, orchard airblast and ground hydraulic methods. After the policy is in place, the Agency may impose further refinements in spray drift management practices to reduce off-target drift and risks associated with aerial as well as other application types where appropriate.

6.0 INCIDENT REPORTS

HED concludes that the majority of the reported incidents of diazinon poisoning occur in the home. Incident data taken from the "Review of Diazinon Incident Reports" (HED memorandum from J. Blondell, 7/98 to T. Leighton) are summarized below. Detailed descriptions of 860 cases submitted to the California Pesticide Illness Surveillance Program (1982-1995) constituting the most recent incident information on diazinon poisonings were summarized and reviewed for this risk assessment. These data indicate that in 521 of these cases, diazinon was used alone and was judged to be responsible for the health effects reported. Only cases with a definite, probable, or possible relationship were reviewed. Diazinon ranked 5th as a cause of systemic poisoning in California from 1990 through 1994. Table 20 presents the types of illnesses reported by year.

Table 20
Cases Due to Diazinon Exposure in California Reported by Type of Illness and Year, 1982-1995

Year	Illness Type					
	Systemic	Eye	Skin	Resp	Combination[b]	Total
1982	41	7	-	-	-	48
1983	40	8	4	-	-	52
1984	28	7	3	-	-	38
1985	22	5	-	-	1	28
1986	39	5	2	-	-	46
1987	24	6	2	-	-	32
1988	45	6	3	-	-	54
1989	23	6	-	2	-	31
1990	57	4	2	4	1	68
1991	15	4	3	1	2	25
1992	15	3	3	2	1	24
1993	19	4	2	-	-	25
1994	19	3	1	-	-	23
1995	17	4	2	3	1	27
Total	404	72	27	12	6	521

[a] Category includes cases where skin, eye, or respiratory effects were also reported.
[b] Category includes combined irritative effects to eye, skin, and respiratory system.

Of the total number of diazinon incidents reported (521): 404 persons had systemic illnesses or 77.5% of 521 persons, 72 persons had eye illnesses or 13.8%, and only 5% of the cases involve skin injuries or illnesses.

Non-occupational categories accounted for just over half of the total cases and 60% of the systemic cases. Thirty percent of the non-occupational cases resulted from residues left from structural applications. By far the majority of these cases occurred when occupants reentered a structure that had just been sprayed. One of the most serious cases of this type involve 35 people who got sick when a carpet was improperly treated. Bystanders were present during the application and affected in at least 20 of these cases. There were even a few cases where the outside of a building was treated and people inside claimed exposure and illness.

Nearly half of the diazinon exposures reported in California involve workers, mostly in agricultural settings.

Those who apply diazinon by hand were at greater risk than any other category, accounting for 38% of the occupational categories. This is also the category responsible for over one-half of the adverse effects to the eyes. Drift exposures and persons handling product in transport or in warehouses combined to account for over a quarter of the remaining occupational cases. Detailed review of the occupational cases found that lack of protective equipment was involved in at least 19 incidents. Equipment failure (e.g., hose breaks) was a factor in at least 26 cases. And inadequate precautions when cleaning or maintaining equipment were involved in at least 12 cases. Earlier summaries prepared by California for the years 1975 through 1982 examined all pesticide illnesses involving workers exposed to drift or residue indoors (CDFA 1976-1982). Of the 471 systemic illnesses reported during this six year time period, 123 (26%) were due to diazinon, more than for any other pesticide. In 1979, 57 workers were affected in a single incident when they reentered their offices which had not been adequately ventilated.

A report of all hospitalized cases in California for 1982 through 1994 ranked diazinon first as the leading cause of hospitalization. However, a third of these cases were attempted suicides or homicides. Among the accidental hospitalized cases most occurred among homeowners who misused the product or left it within the reach of very young children. Among the occupational cases that were hospitalized there were four applicators, three of whom were applying the product by hand.

Data from previous years incident reports indicate that diazinon was the 6th leading cause of pesticide related deaths for the years 1961, 1969, 1973, and 1974. Diazinon averaged 2.5 deaths per year during the four survey years and accounted for 3% of the total deaths. Intentional ingestion of diazinon was excluded from these figures. From 1974 to 1976, a sampling of 12% of hospitals nationwide was conducted and revealed that during this period diazinon was estimated to have been the cause of 88 hospitalizations per year and accounted for 3% of the hospitalizations. Of these 88 hospitalizations per year, 12% were related to occupational exposures, 61% to non-occupational and home uses, 24% to intentional ingestion, and 3% from unknown causes.

Another survey of hospitals nationwide conducted from 1977 to 1982 to estimate pesticide related hospitalizations ranked diazinon first in pesticide-related poisoning incidents. Diazinon accounted for 5.6% of the hospitalizations/incidents. Ninety-one percent of the diazinon related exposures requiring hospitalization occurred non-occupationally. A 1984 survey of hospital emergency room cases related to pesticide poisonings indicated that in 2% of the cases diazinon was implicated as the cause, and of the diazinon poisonings reported, 88% of the exposures occurred in the home.

7.0 DATA NEEDS

Handler and postapplication data requirements will be determined based on risk mitigation meetings with the registrant and growers. There are no chemical specific exposure data for diazinon sheep treatments and mushroom houses; therefore the Agency is requiring data and/or further clarification of the use patterns involving workers handling or working with sheep treatments which may result in post-application exposure.

Mushroom houses: No data were submitted in support of postapplication exposures for workers re-

entering mushroom houses. EPA has identified potential dermal and inhalation exposures resulting from this indoor application. The Diazinon 50W label (EPA Reg. No. 100-460) directions for mushroom houses is to use a spray dilution rate of 0.04 to 0.05 lb ai/gallon and apply "on outside and inside walls, floors and sideboards of mushroom houses after compost has been pasteurized by heating ... and spray over the plastic covering the beds and trays after spawning." Potential dermal exposures in mushroom houses may arise from workers contacting treated surfaces as all surfaces may be treated. The potential inhalation exposures may result from air concentrations of diazinon in the mushroom house resulting from the application before or after ventilation. Additional data are needed to estimate the potential for dermal exposure in mushroom houses including (1) identification of mushroom house activities that may result in dermal contact, (2) the residue levels on the sideboards and plastic covering the beds and trays, and (3) direct dermal exposure measurements or transfer coefficients. Additional data are also needed to determine air concentrations of diazinon over time. In lieu of air concentration data to calculate exposure/risk, HED determined an allowable air concentration based on the inhalation LOAEL of 0.1 mg/m^3 from a 21-day whole body aerosol study exposing rats 6-hours per day and the uncertainty factor of 300. The estimated 6 hour time-weighted-average (TWA) allowable air concentration is 0.0003 mg/m^3 (i.e., LOAEL of 0.1 mg/m^3 divided by 300 UF). This calculation assumes that the rat and human activity level for a breathing weight is equivalent. The LOD from the air sampling portion of the diazinon lawn treatment study (MRID 449591-01) is listed as 0.0006 mg/m^3 (see study results in this chapter for actual air concentration levels at specific time intervals).

8.0 REFERNCES

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APPENDIX A
OCCUPATIONAL HANDLER EXPOSURE AND RISK ESTIMATES

Table A-1
Summary of Occupational Exposure and Risk Estimates for Diazinon
BASELINE

Scenario	Dermal UE mg/lb ai	Inhalation UE ug/lb ai	Application Rate (a)	Daily Acres Treated (b)	Dose Estimates (mg/kg/day) Dermal ©	Inhalation (d)	MOEs Baseline (e) Dermal	Inhalation
Mixing Loading Liquids								
Aerial (1a)	2.9	1.2	0.5	350	7	0.003	0.138	8.67
	2.9	1.2	1.25	350	18	0.0075	0.055	3.47
	2.9	1.2	1.25	1200	62	0.026	0.016	1.01
Chemigation (1b)	2.9	1.2	3	35	4	0.0018	0.230	14.44
Groundboom (1c)	2.9	1.2	0.75	80	2	0.0010	0.402	25.28
	2.9	1.2	0.75	200	6	0.0026	0.161	10.11
	2.9	1.2	4	80	13	0.0055	0.075	4.74
	2.9	1.2	4	200	33	0.0137	0.030	1.90
Airblast (1d)	2.9	1.2	1	20	1	0.0003	1.207	75.83
	2.9	1.2	1	40	2	0.0007	0.603	37.92
	2.9	1.2	2	20	2	0.0007	0.603	37.92
	2.9	1.2	2	40	3	0.0014	0.302	18.96
	2.9	1.2	3	20	2	0.0010	0.402	25.28
Rights-of-Way Sprayer (1e)	2.9	1.2	0.5	40	1	0.0003	1.207	75.83
High-pressure Handwand	2.9	1.2	0.04	1000	2	0.0007	0.603	37.92
(Livestock Areas) (1f)	2.9	1.2	0.08	1000	3	0.0014	0.302	18.96
Mixing/Loading Wettable Powders								
Aerial (2a)	3.7	43	0.5	350	9	0.11	0.108	0.24
	3.7	43	1.25	350	23	0.27	0.043	0.10
	3.7	43	1.25	1200	79	0.92	0.013	0.03
Chemigation (2b)	3.7	43	3	35	6	0.0645	0.180	0.40
Groundboom (2c)	3.7	43	0.75	80	3	0.037	0.315	0.71
	3.7	43	0.75	200	8	0.092	0.126	0.28
	3.7	43	4	80	17	0.197	0.059	0.13
	3.7	43	4	200	42	0.491	0.024	0.05
Airblast (2d)	3.7	43	1	20	1	0.012	0.946	2.12
	3.7	43	1	40	2	0.025	0.473	1.06
	3.7	43	2	20	2	0.025	0.473	1.06
	3.7	43	2	40	4	0.049	0.236	0.53
	3.7	43	3	20	3	0.037	0.315	0.71
Rights-of-Way Sprayer (2e)	3.7	43	0.5	40	1	0.012	0.946	2.12
High-pressure Handwand	3.7	43	0.04	1000	2	0.025	0.473	1.06
(Livestock Areas) (2f)	3.7	43	0.08	1000	4	0.049	0.236	0.53
Seed treatment (2g)	ND	1.6	0.094	50	ND	0.0001	ND	242.02
Loading Granules								
Tractor-drawn	0.0084	1.7	4	80	0	0.008	26.042	3.35
broadcast spreaders (3)	0.0084	1.7	4	200	0	0.019	10.417	1.34
Applying Sprays/Liquids								
Airblast (4a)	0.36	4.5	1	20	0.10	0.001	9.722	20.22
	0.36	4.5	1	40	0.21	0.003	4.861	10.11
	0.36	4.5	2	20	0.21	0.003	4.861	10.11
	0.36	4.5	2	40	0.41	0.005	2.431	5.06
	0.36	4.5	3	20	0.31	0.004	3.241	6.74
Groundboom (4b)	0.014	0.74	0.75	80	0.01	0.001	83.333	40.99
	0.014	0.74	0.75	200	0.03	0.002	33.333	16.40
	0.014	0.74	4	80	0.06	0.003	15.625	7.69
	0.014	0.74	4	200	0.16	0.008	6.250	3.07
Paintbrush (4c)	180	280	0.04	5	0.51	0.001	1.944	32.50
	180	280	0.08	5	1.03	0.002	0.972	16.25

Table A-1
Summary of Occupational Exposure and Risk Estimates for Diazinon
BASELINE

Scenario	Dermal UE mg/lb ai	Inhalation UE ug/lb ai	Application Rate (a)	Daily Acres Treated (b)	Dose Estimates (mg/kg/day) Dermal ©	Inhalation (d)	MOEs Baseline (e) Dermal	Inhalation
Airless Sprayer (4d)	38	830	0.04	40	0.87	0.019	1.151	1.37
	38	830	0.08	40	1.74	0.038	0.576	0.69
High-pressure Handwand	1.8	79	0.04	1000	1.03	0.045	0.972	0.58
(Livestock Areas) (4e)	1.8	79	0.08	1000	2.06	0.090	0.486	0.29
Rights-of-Way Sprayer (4f)	1.3	3.9	0.5	40	0.37	0.001	2.692	23.33
Fixed-wing Aircraft (4g)	ND	ND	1.25	350	ND	ND	ND	ND
	ND	ND	1.25	1200	ND	ND	ND	ND

Table A-1
Summary of Occupational Exposure and Risk Estimates for Diazinon
BASELINE

Scenario	Dermal UE mg/lb ai	Inhalation UE ug/lb ai	Application Rate (a)	Daily Acres Treated (b)	Dose Estimates (mg/kg/day) Dermal ©	Inhalation (d)	MOEs Baseline (e) Dermal	Inhalation
Applying Granules								
Tractor-drawn	0.0099	1.2	4	80	0.045	0.005	22.1	4.74
broadcast spreader (5)	0.0099	1.2	4	200	0.113	0.014	8.8	1.90
Flagging								
Sprays (6)	0.011	0.35	0.5	350	0.028	0.001	36.4	29.71
	0.011	0.35	1.25	350	0.069	0.002	14.5	11.89
	0.011	0.35	1.25	1200	0.236	0.0075	4.2	3.47
M/L/A liquids								
Low Pressure Handwand (7a)	100	30	0.04	40	2	0.001	0.438	37.92
	100	30	0.08	40	5	0.001	0.219	18.96
Backpack sprayer (7b)	ND	30	0.04	40	ND	0.001	ND	37.92
High pressure handwand	3.5	120	0.04	1000	2	0.069	0.500	0.38
(Greenhouse) (7c)	3.5	120	0.08	1000	4	0.137	0.250	0.19
Handgun LCO Sprayer (7d)	0.69	1.5	4	5	0	0.000	5.072	60.67
M/L/A wettable powders								
Low pressure handwand (8a)	8.6	1100	0.04	40	0.20	0.025	5.087	1.03
Handgun LCO Sprayer (8b)	1	62	4	5	0.29	0.018	3.500	1.47
Applying/loading granules								
Belly Grinder (9a)	10	62	4.4	1	1	0.004	1.591	6.67
Push-type spreader (9b)	0.31	7.1	4.4	5	0.10	0.002	10.264	11.65

ND = no data.

(a) Application Rate is in lb ai/A or lb ai/gal.

(b) Acres treated or gal/day

© Dermal dose (mg/kg/day) = Dermal unit exposure (mg/lb ai) * Application rate (lb ai/A or lb ai/gal) * acres or gal treated/day / 70 kg.

(d) Inhalation dose (mg/kg/day) = Inhalation unit exposure (ug/lb ai) * Application rate (lb ai/A or lb ai/gal) * acres or gal treated/day * 1e-3 mg/ug / 70 kg.

(e) MOE = LOAEL or NOAEL/dose, where dermal NOAEL is 1 mg/kg/day and inhalation LOAEL is 0.026 mg/kg/day. Target MOE is 100 for dermal and 300 for inhalation.

Table A-2
Summary of Occupational Exposure and Risk Estimates for Diazinon
PERSONAL PROTECTION EQUIPMENT (PPE)

Scenario	Dermal UE mg/lb ai	Inhalation UE ug/lb ai	Application Rate (a)	Daily Acres Treated (b)	Dose Estimates (mg/kg/day) Dermal ©	Inhalation (d)	MOEs PPE (e) Dermal	Inhalation	ARI (f) (short-term)	Total MOE Int and Long Term
Mixing Loading Liquids										
Aerial (1a)	0.017	0.12	0.5	350	0.043	0.0003	23.5	86.7	0.13	18.51
	0.017	0.12	1.25	350	0.106	0.0008	9.4	34.7	0.05	7.40
	0.017	0.12	1.25	1200	0.364	0.0026	2.7	10.1	0.02	2.16
Chemigation (1b)	0.017	0.12	3	35	0.026	0.0002	39.2	144.4	0.22	30.84
Groundboom (1c)	0.017	0.12	0.75	80	0.015	0.0001	68.6	252.8	0.38	53.97
	0.017	0.12	0.75	200	0.036	0.0003	27.5	101.1	0.15	21.59
	0.017	0.12	4	80	0.078	0.0005	12.9	47.4	0.07	10.12
	0.017	0.12	4	200	0.194	0.0014	5.1	19.0	0.03	4.05
Airblast (1d)	0.017	0.12	1	20	0.005	0.00003	205.9	758.3	1.13	161.92
	0.017	0.12	1	40	0.010	0.0001	102.9	379.2	0.57	80.96
	0.017	0.12	2	20	0.010	0.0001	102.9	379.2	0.57	80.96
	0.017	0.12	2	40	0.019	0.0001	51.5	189.6	0.28	40.48
	0.017	0.12	3	20	0.015	0.0001	68.6	252.8	0.38	53.97
Rights-of-Way Sprayer (1e)	0.017	0.12	0.5	40	0.005	0.00003	205.9	758.3	1.13	161.92
High-pressure Handwand (1f)	0.017	0.12	0.04	1000	0.010	0.0001	102.9	379.2	0.57	80.96
(Livestock Areas)	0.017	0.12	0.08	1000	0.019	0.0001	51.5	189.6	0.28	40.48
Mixing/Loading Wettable Powders										
Aerial (2a)	0.13	4.3	0.5	350	0.325	0.01	3.08	2.42	0.01	1.35
	0.13	4.3	1.25	350	0.813	0.03	1.23	0.97	0.003	0.54
	0.13	4.3	1.25	1200	2.786	0.09	0.36	0.28	0.001	0.16
Chemigation (2b)	0.13	4.3	3	35	0.195	0.00645	5.13	4.03	0.011	2.26
Groundboom (2c)	0.13	4.3	0.75	80	0.111	0.004	8.97	7.05	0.019	3.95
	0.13	4.3	0.75	200	0.279	0.009	3.59	2.82	0.007	1.58
	0.13	4.3	4	80	0.594	0.020	1.68	1.32	0.003	0.74
	0.13	4.3	4	200	1.486	0.049	0.67	0.53	0.001	0.30
Airblast (2d)	0.13	4.3	1	20	0.037	0.001	26.92	21.16	0.06	11.85
	0.13	4.3	1	40	0.074	0.002	13.46	10.58	0.03	5.92
	0.13	4.3	2	20	0.074	0.002	13.46	10.58	0.03	5.92
	0.13	4.3	2	40	0.149	0.005	6.73	5.29	0.01	2.96
	0.13	4.3	3	20	0.111	0.004	8.97	7.05	0.02	3.95
Rights-of-Way Sprayer (2e)	0.13	4.3	0.5	40	0.037	0.001	26.92	21.16	0.06	11.85
High-pressure Handwand (2f)	0.13	4.3	0.04	1000	0.074	0.002	13.46	10.58	0.03	5.92
(Livestock Areas)	0.13	4.3	0.08	1000	0.149	0.005	6.73	5.29	0.01	2.96
Seed Treatment (2g)	9.4	0.16	0.094	50	0.631	0.00001	1.58	2420.21	0.02	1.58
Loading Granules										
Tractor-drawn broadcast spreaders (3)	0.0034	0.17	4	80	0.016	0.001	64.34	33.46	0.10	22.01
	0.0034	0.17	4	200	0.039	0.002	25.74	13.38	0.04	8.80
Applying Sprays/Liquids										
Airblast (4a)	0.22	0.45	1	20	0.063	0.0001	15.9	202.2	0.13	14.75
	0.22	0.45	1	40	0.126	0.0003	8.0	101.1	0.06	7.37
	0.22	0.45	2	20	0.126	0.0003	8.0	101.1	0.06	7.37
	0.22	0.45	2	40	0.251	0.0005	4.0	50.6	0.03	3.69
	0.22	0.45	3	20	0.189	0.0004	5.3	67.4	0.04	4.92
Groundboom (4b)	0.01	0.074	0.75	80	0.009	0.0001	116.7	409.9	0.63	90.82

Table A-2
Summary of Occupational Exposure and Risk Estimates for Diazinon
PERSONAL PROTECTION EQUIPMENT (PPE)

Scenario	Dermal UE mg/lb ai	Inhalation UE ug/lb ai	Application Rate (a)	Daily Acres Treated (b)	Dose Estimates (mg/kg/day) Dermal ©	Inhalation (d)	MOEs PPE (e) Dermal	Inhalation	ARI (f) (short-term)	Total MOE Int and Long Term
	0.01	0.074	0.75	200	0.021	0.0002	46.7	164.0	0.25	36.33
	0.01	0.074	4	80	0.046	0.0003	21.9	76.9	0.12	17.03
	0.01	0.074	4	200	0.114	0.0008	8.8	30.7	0.05	6.81
Paintbrush (4c)	22	28	0.04	5	0.063	0.0001	15.9	325.0	0.14	15.17
	22	28	0.08	5	0.126	0.0002	8.0	162.5	0.07	7.58
Airless Sprayer (4d)	14	83	0.04	40	0.320	0.0019	3.1	13.7	0.02	2.54
	14	83	0.08	40	0.640	0.0038	1.6	6.9	0.01	1.27
High-pressure Handwand	0.36	7.9	0.04	1000	0.206	0.0045	4.9	5.8	0.01	2.64
(Livestock Areas) (4e)	0.36	7.9	0.08	1000	0.411	0.0090	2.4	2.9	0.01	1.32
Rights-of-Way Sprayer (4f)	0.29	0.39	0.5	40	0.08	0.0001	12	233	0.10	11.48
Fixed-wing Aircraft (4g)	ND	ND	0.5	350	ND	ND	ND	ND		
	ND	ND	1.25	350	ND	ND	ND	ND		
	ND	ND	1.25	1200	ND	ND	ND	ND		
Applying Granules										
Tractor-drawn	0.0042	0.12	4	80	0.019	0.001	52.1	47.4	0.12	24.81
broadcast spreader (5)	0.0042	0.12	4	200	0.048	0.001	20.8	19.0	0.05	9.93
Flagging										
Sprays (6)	0.01	0.035	0.5	350	0.025	0.0001	40.0	297.1	0.28	35.25
	0.01	0.035	1.25	350	0.063	0.0002	16.0	118.9	0.11	14.10
	0.01	0.035	1.25	1200	0.214	0.00075	4.7	34.7	0.03	4.11
M/L/A liquids										
Low Pressure Handwand (7a)	0.37	3	0.04	40	0.008	0.0001	118.2	379.2	0.61	90.13
	0.37	3	0.08	40	0.017	0.0001	59.1	189.6	0.31	45.07
Backpack sprayer (7b)	1.6	3	0.04	40	0.037	0.0001	27.3	379.2	0.22	25.50
High pressure handwand	1.6	12	0.04	1000	1	0.007	1.1	3.8	0.01	0.85
(Greenhouse) (7c)	1.6	12	0.08	1000	2	0.014	0.5	1.9	0.003	0.42
Handgun LCO Sprayer (7d)	0.25	0.15	4	5	0.0714	0.00004	14.0	606.7	0.13	13.68
M/L/A wettable powders										
Low pressure handwand (8a)	6.2	110	0.04	40	0.14	0.003	7.1	10.3	0.02	4.19
Handgun LCO Sprayer (8b)	0.39	6.2	4	5	0.11	0.002	9.0	14.7	0.03	5.57
Applying/loading granules										
Belly Grinder (9a)	5.7	6.2	3.7	1	0.30	0.0003	3.3	79.3	0.03	3.19
	5.7	6.2	4.4	1	0.36	0.0004	2.8	66.7	0.02	2.68
Push-type spreader (9b)	0.24	0.71	3.7	5	0.06	0.0002	15.8	138.6	0.12	14.16
	0.24	0.71	4.4	5	0.08	0.0002	13.3	116.5	0.10	11.90
	0.24	0.71	3.7	3	0.04	0.0001	26.3	230.9	0.20	23.59
	0.24	0.71	4.4	3	0.05	0.0001	22.1	194.2	0.16	19.84

ND = No data

(a) Application Rate is in lb ai/A or lb ai/gal.

(b) Acres treated or gal/day

© Dermal dose (mg/kg/day) = Dermal unit exposure (mg/lb ai) * Application rate (lb ai/A or lb ai/gal) * acres or gal treated/day / 70 kg.

Table A-2
Summary of Occupational Exposure and Risk Estimates for Diazinon
PERSONAL PROTECTION EQUIPMENT (PPE)

Scenario	Dermal UE mg/lb ai	Inhalation UE ug/lb ai	Application Rate (a)	Daily Acres Treated (b)	Dose Estimates (mg/kg/day) Dermal ©	Inhalation (d)	MOEs PPE (e) Dermal	Inhalation	ARI (f) (short-term)	Total MOE Int and Long Term

(d) Inhalation dose (mg/kg/day) = Inhalation unit exposure (ug/lb ai) * Application rate (lb ai/A or lb ai/gal) * acres or gal treated/day * 1e-3 mg/ug / 70 kg.

(e) MOE = LOAEL or NOAEL/dose, where dermal NOAEL is 1 mg/kg/day and inhalation LOAEL is 0.026 mg/kg/day. Target MOE is 100 for dermal and 300 for inhalation.

Table A-3
Summary of Occupational Exposure and Risk Estimates for Diazinon
ENGINEERING CONTROLS

Scenario	Dermal UE mg/lb ai	Inhalation UE ug/lb ai	Application Rate (a)	Daily Acres Treated (b)	Dose Estimates (mg/kg/day) Dermal ©	Inhalation (d)	MOEs Eng Controls (e) Dermal	Inhalation	ARI (f) (short-term)	Total MOE Int and Long Term
Mixing Loading Liquids										
Aerial (1a)	0.0086	0.083	0.5	350	0.022	0.0002	46.5	125.3	0.22	34
	0.0086	0.083	1.25	350	0.054	0.0005	18.6	50.1	0.09	14
	0.0086	0.083	1.25	1200	0.184	0.002	5.4	14.6	0.03	4.0
Chemigation (1b)	0.0086	0.083	3	35	0.013	0.0001245	77.5	208.8	0.37	57
Groundboom (1c)	0.0086	0.083	0.75	80	0.007	0.0001	135.7	365.5	0.64	99
	0.0086	0.083	0.75	200	0.018	0.0002	54.3	146.2	0.26	40
	0.0086	0.083	4	80	0.039	0.0004	25.4	68.5	0.12	19
	0.0086	0.083	4	200	0.098	0.00095	10.2	27.4	0.05	7.4
Airblast (1d)	0.0086	0.083	1	20	0.002	0.00002	407.0	1096.4	1.93	297
	0.0086	0.083	1	40	0.005	0.00005	203.5	548.2	0.96	148
	0.0086	0.083	2	20	0.005	0.00005	203.5	548.2	0.96	148
	0.0086	0.083	2	40	0.010	0.00009	101.7	274.1	0.48	74
	0.0086	0.083	3	20	0.007	0.00007	135.7	365.5	0.64	99
Rights-of-Way Sprayer (1e)	0.0086	0.083	0.5	40	0.002	0.00002	407.0	1096.4	1.93	297
High-pressure Handwand (Livestock Areas) (1f)	0.0086	0.083	0.04	1000	0.005	0.00005	203.5	548.2	0.96	148
	0.0086	0.083	0.08	1000	0.010	0.0001	101.7	274.1	0.48	74
Mixing/Loading Wettable Powders										
Aerial (2a)	0.021	0.24	0.5	350	0.053	0.0006	19.05	43.33	0.08	13
	0.021	0.24	1.25	350	0.131	0.0015	7.62	17.33	0.03	5.3
	0.021	0.24	1.25	1200	0.450	0.0051	2.22	5.06	0.01	1.5
Chemigation (2b)	0.021	0.24	3	35	0.032	0.0004	31.75	72.22	0.14	22
Groundboom (2c)	0.021	0.24	0.75	80	0.018	0.0002	55.56	126.39	0.24	39
	0.021	0.24	0.75	200	0.045	0.0005	22.22	50.56	0.10	15
	0.021	0.24	4	80	0.096	0.0011	10.42	23.70	0.04	7
	0.021	0.24	4	200	0.240	0.0027	4.17	9.48	0.02	3
Airblast (2d)	0.021	0.24	1	20	0.006	0.0001	166.67	379.17	0.72	116
	0.021	0.24	1	40	0.012	0.0001	83.33	189.58	0.36	58
	0.021	0.24	2	20	0.012	0.0001	83.33	189.58	0.36	58
	0.021	0.24	2	40	0.024	0.0003	41.67	94.79	0.18	29
	0.021	0.24	3	20	0.018	0.0002	55.56	126.39	0.24	39
Rights-of-Way Sprayer (2e)	0.021	0.24	0.5	40	0.006	0.0001	166.67	379.17	0.72	116
High-pressure Handwand (Livestock Areas) (2f)	0.021	0.24	0.04	1000	0.012	0.0001	83.33	189.58	0.36	58
	0.021	0.24	0.08	1000	0.024	0.0003	41.67	94.79	0.18	29
Seed Treatment (2g)	Not Feasible	Not Feasible								
Loading Granules										
Tractor-drawn broadcast spreaders (3)	0.00017	0.034	4	80	0.001	0.00016	1286.76	167.28	0.53	148
	0.00017	0.034	4	200	0.002	0.00039	514.71	66.91	0.21	59
Applying Sprays/Liquids										
Airblast (4a)	0.019	0.45	1	20	0.005	0.00013	184.2	202.2	0.49	96
	0.019	0.45	1	40	0.011	0.00026	92.1	101.1	0.25	48
	0.019	0.45	2	20	0.011	0.00026	92.1	101.1	0.25	48
	0.019	0.45	2	40	0.022	0.00051	46.1	50.6	0.12	24
	0.019	0.45	3	20	0.016	0.00039	61.4	67.4	0.16	32

Table A-3
Summary of Occupational Exposure and Risk Estimates for Diazinon
ENGINEERING CONTROLS

Scenario	Dermal UE mg/lb ai	Inhalation UE ug/lb ai	Application Rate (a)	Daily Acres Treated (b)	Dose Estimates (mg/kg/day) Dermal ©	Inhalation (d)	MOEs Eng Controls (e) Dermal	Inhalation	ARI (f) (short-term)	Total MOE Int and Long Term
Groundboom (4b)	0.005	0.043	0.75	80	0.004	0.00004	233.3	705.4	1.17	175
	0.005	0.043	0.75	200	0.011	0.00009	93.3	282.2	0.47	70
	0.005	0.043	4	80	0.023	0.00020	43.8	132.3	0.22	33
	0.005	0.043	4	200	0.057	0.00049	17.5	52.9	0.09	13
Paintbrush (4c)	Not Feasible	Not Feasible	0.04	5	Not Feasible					
Airless Sprayer (4d)	Not Feasible	Not Feasible	0.04	40	Not Feasible					
High-pressure Handwand (Livestock Areas) (4e)	Not Feasible	Not Feasible	0.04	1000	Not Feasible					
Rights-of-Way Sprayer (4f)	Not Feasible	Not Feasible	0.5	40	Not Feasible					
Fixed-wing Aircraft (4g)	0.005	0.068	0.5	350	0.01	0.000	80	153	0.31	53
	0.005	0.068	1.25	350	0.03	0.000	32	61	0.12	21
	0.005	0.068	1.25	1200	0.11	0.001	9	18	0.04	6.1
Applying Granules										
Tractor-drawn broadcast spreader (5)	0.0021	0.22	4	80	0.010	0.001	104.2	25.9	0.08	21
	0.0021	0.22	4	200	0.024	0.003	41.7	10.3	0.03	8
Flagging										
Sprays (6)	0.00022	0.007	0.5	350	0.001	0.00002	1818.2	1485.7	3.89	818
	0.00022	0.007	1.25	350	0.001	0.00004	727.3	594.3	1.56	327
	0.00022	0.007	1.25	1200	0.005	0.00015	212.1	173.3	0.45	95
M/L/A liquids										
Low Pressure Handwand (7a)	Not Feasible	Not Feasible	0.04	40	Not Feasible					
Backpack sprayer (7b)	Not Feasible	Not Feasible	0.04	40	Not Feasible					
High pressure handwand (Greenhouse) (7c)	Not Feasible	Not Feasible	0.04	1000	Not Feasible					
Handgun LCO Sprayer (7d)	Not Feasible	Not Feasible	4	5	Not Feasible					
M/L/A wettable powders										
Low pressure handwand (8a)	Not Feasible	Not Feasible	0.04	40						
Handgun LCO Sprayer (8b)	Not Feasible	Not Feasible	4	5						
Applying/loading granules										
Belly Grinder (9a)	Not Feasible	Not Feasible	4.4	1	Not Feasible					
Push-type spreader (9b)	Not Feasible	Not Feasible	4.4	5	Not Feasible					

ND = No Data

(a) Application Rate is in lb ai/A or lb ai/gal.

(b) Acres treated or gal/day

© Dermal dose (mg/kg/day) = Dermal unit exposure (mg/lb ai) * Application rate (lb ai/A or lb ai/gal) * acres or gal treated/day / 70 kg.

(d) Inhalation dose (mg/kg/day) = Inhalation unit exposure (ug/lb ai) * Application rate (lb ai/A or lb ai/gal) * acres or gal treated/day * 1e-3 mg/ug / 70 kg.

(e) MOE = LOAEL or NOAEL/dose, where dermal NOAEL is 1 mg/kg/day and inhalation LOAEL is 0.026 mg/kg/day.

APPENDIX B
RE-ENTRY INTERVAL (REI) CALCULATIONS

Occupational Post-Application Risk Assessment Calculator Version 1 (8/9/00)

Chemical:	Diazinon Short-term Assessment
Reason:	TC Policy 3.1
Date:	10/25/00
Assessor:	Tim Leighton

Applicable TC Groups:	Rate (lb ai/acre)	Surrogate DFR	Diazinon treated Crops
Berry, Low	1 to 3	cabbage (CA)	blackberries, raspberries, blueberries, cranberries, strawberries
Bunch/Bundle	1	cabbage (CA)	hops
Field row crop, Low/Medium	0.75	cabbage (CA)	beans, peas
Field row crop, Tall	1.25	cabbage (CA)	sweet corn, sorghum
Cut flowers	2	cabbage (CA)	carnation, chrysanthemum
Tree, "fruit", Deciduous	2	citrus (orange, CA)	apples, apricots, cherries, figs, nectarines, peaches, pears, plums
Tree nuts	3	citrus (orange, CA)	almonds
Vegetable, "root"	0.5	cabbage (CA)	beets, carrots, onions, parsnips, potatoes, radishes
Vegetable, "cucurbit"	0.75	cabbage (CA)	cucumbers, melons
Vegetable, "fruiting"	0.75	cabbage (CA)	peppers, tomatoes
Vegetable, "head and stem Brassica"	0.5	cabbage (CA)	cole crops
Vegetable, "leafy"	0.5	cabbage (CA)	lettuce, parsley, spinach, swiss chard
Vine & trellis crops	1	cabbage (CA)	grapes

DFR/TTR Data Defaults:	
Initial Percent of Rate as DFR (%):	20
Dissipation Rate per day (%):	10
Initial Percent of Rate as TTR (%):	5

Short- and Intermediate-term Toxicology & Exposure Factor Inputs:	
Uncertainty Factor:	100 Short-term and 300 Intermediate-term
NOAEL (mg/kg/day):	1
Source of NOAEL:	21 Day Rabbit Dermal Study
Adult Exposure Duration (hrs/day):	8
Adult Body Weight (kg):	70
Dermal Abs. (%):	100

Note: If a dermal administration toxicity study is the source of the endpoint used for risk assessment, then the dermal absorption factor is set to 100 % to satisfy the calculations in this spreadsheet program.

Occupational Post-Application Risk Assessment Calculator Version 1 (8/9/00)

Chemical:	Diazinon	
Reason:		TC Policy 3.1
Date:	10/25/00	
Transfer Coefficient Group:	Berry, Low	
Specific Crop(s) Considered:		blackberries, raspberries, blueberries, cranberries, strawberries
Application Rate of Crop (lb ai/A):	3	

DFR Data Summary

Data Source (enter 1 if data available, 0 if defaults):	1	
Source:		Cabbage DFR Data (MRID 402029-02)
Slope of Semilog Regression:	-0.618	
[Initial] (ug/cm2):	0.164	
Study Application Rate (lb ai/A):	0.5	
Limit of Quantification (ug/cm2):	0.002	

Exposure Inputs Summary

Exposure Potential	Transfer Coefficients (cm2/hour)		Activities
	Used For RA	Range	
Very Low	N/A	N/A	N/A
Low	400	400 to 1800	Irrigation, scouting, weeding, pruning, thinning, rake harvest of cranberries, mulching
Medium	N/A	N/A	N/A
High	1500	400 to 1800	for blueberries or strawberries: harvesting, hand pruning, pinching, training
Very High	N/A	N/A	N/A

DAT	DFR LEVELS (ug/cm2)		DOSE (mg/kg/day)		MOES	
	Not Adjusted	Adjusted For Rate	Low Exposure	High Exposure	Low Exposure	High Exposure
0	0.164	0.984	0.045	0.169	22.2	5.9
1	0.088	0.530	0.024	0.091	41.2	11.0
2	0.048	0.286	0.013	0.049	76.5	20.4
3	0.026	0.154	0.007	0.026	141.9	37.9
4	0.014	0.083	0.004	0.014	263.3	70.2
5	0.007	0.045	0.002	0.008	488.6	130.3
6	0.004	0.024	0.001	0.004	906.4	241.7
7	0.002	0.013	0.001	0.002	1681.6	448.4
8	0.001	0.007	0.000	0.001	3119.6	831.9
9	0.001	0.004	0.000	0.001	5787.6	1543.4
10	0.000	0.002	0.000	0.000	10737.2	2863.3
11	0.000	0.001	0.000	0.000	19919.9	5312.0
12	0.000	0.001	0.000	0.000	36955.6	9854.8
13	0.000	0.000	0.000	0.000	68560.6	18282.8
14	0.000	0.000	0.000	0.000	127194.6	33918.6
15	0.000	0.000	0.000	0.000	235973.3	62926.2
16	0.000	0.000	0.000	0.000	437780.9	116741.6
17	0.000	0.000	0.000	0.000	812177.2	216580.6
18	0.000	0.000	0.000	0.000	1506762.4	401803.3
19	0.000	0.000	0.000	0.000	2795366.6	745431.1
20	0.000	0.000	0.000	0.000	5186003.0	1382934.1
21	0.000	0.000	0.000	0.000	9621144.8	2565638.6
22	0.000	0.000	0.000	0.000	17849281.5	4759808.4
23	0.000	0.000	0.000	0.000	33114235.2	8830462.7
24	0.000	0.000	0.000	0.000	61433989.5	16382397.2

25	0.000	0.000	0.000	0.000	113973191.2	30392851.0
26	0.000	0.000	0.000	0.000	211444648.8	56385239.7
27	0.000	0.000	0.000	0.000	392275051.7	104606680.5
28	0.000	0.000	0.000	0.000	727754129.0	194067767.7
29	0.000	0.000	0.000	0.000	1350139576.7	360037220.4
30	0.000	0.000	0.000	0.000	2504797711.1	667946056.3

Occupational Post-Application Risk Assessment Calculator Version 1 (8/9/00)

Chemical:	Diazinon
Reason:	TC Policy 3.1
Date:	10/25/00
Transfer Coefficient Group:	Bunch and bundle
Specific Crop(s) Considered:	hops
Application Rate of Crop (lb ai/A):	1

DFR Data Summary

Data Source (enter 1 if data available, 0 if defaults):	1
Source:	Cabbage DFR data (MRID 402029-02)
Slope of Semilog Regression:	-0.618
[Initial] (ug/cm2):	0.164
Study Application Rate (lb ai/A):	0.5
Limit of Quantification (ug/cm2):	0.002

Exposure Inputs Summary

Exposure Potential	Transfer Coefficients (cm2/hour)		Activities
	Used For RA	Range	
Very Low	N/A	N/A	N/A
Low	100	TBD	Irrigation, handweeding and scouting immature/low foliage plants
Medium	1300	1346 to 2308	Irrigation and scouting mature plants
High	2000	1346 to 2308	hand harvesting, stripping, training, thinning, topping, mechanical hop harvest
Very High	N/A	N/A	N/A

DAT	DFR LEVELS (ug/cm2)		DOSE (mg/kg/day)			MOES		
	Not Adjusted	Adjusted For Rate	Low Exposure	Medium Exposure	High Exposure	Low Exposure	Medium Exposure	High Expo
0	0.164	0.328	0.0037	0.0487	0.0750	266.8	20.5	13.3
1	0.088	0.177	0.0020	0.0263	0.0404	494.9	38.1	24.7
2	0.048	0.095	0.0011	0.0142	0.0218	918.2	70.6	45.9
3	0.026	0.051	0.0006	0.0076	0.0117	1703.4	131.0	85.2
4	0.014	0.028	0.0003	0.0041	0.0063	3160.2	243.1	158.0
5	0.007	0.015	0.0002	0.0022	0.0034	5862.8	451.0	293.1
6	0.004	0.008	0.0001	0.0012	0.0018	10876.7	836.7	543.8
7	0.002	0.004	0.0000	0.0006	0.0010	20178.7	1552.2	1008.9
8	0.001	0.002	0.0000	0.0003	0.0005	37435.7	2879.7	1871.8
9	0.001	0.001	0.0000	0.0002	0.0003	69451.3	5342.4	3472.6
10	0.000	0.001	0.0000	0.0001	0.0002	128846.9	9911.3	6442.3
11	0.000	0.000	0.0000	0.0001	0.0001	239038.6	18387.6	11951.9

12	0.000	0.000	0.0000	0.0000	0.0000	443467.8	34112.9	22173.4
13	0.000	0.000	0.0000	0.0000	0.0000	822727.6	63286.7	41136.4
14	0.000	0.000	0.0000	0.0000	0.0000	1526335.7	117410.4	76316.8
15	0.000	0.000	0.0000	0.0000	0.0000	2831679.2	217821.5	141584.0
16	0.000	0.000	0.0000	0.0000	0.0000	5253370.7	404105.4	262668.5
17	0.000	0.000	0.0000	0.0000	0.0000	9746126.3	749702.0	487306.3
18	0.000	0.000	0.0000	0.0000	0.0000	18081149.0	1390857.6	904057.5
19	0.000	0.000	0.0000	0.0000	0.0000	33544399.0	2580338.4	1677220.0
20	0.000	0.000	0.0000	0.0000	0.0000	62232035.4	4787079.6	3111601.8
21	0.000	0.000	0.0000	0.0000	0.0000	115453737.2	8881056.7	5772686.9
22	0.000	0.000	0.0000	0.0000	0.0000	214191378.2	16476259.9	10709568.9
23	0.000	0.000	0.0000	0.0000	0.0000	397370822.3	30566986.3	19868541.1
24	0.000	0.000	0.0000	0.0000	0.0000	737207873.5	56708298.0	36860393.7
25	0.000	0.000	0.0000	0.0000	0.0000	1367678294.9	105206022.7	68383914.7
26	0.000	0.000	0.0000	0.0000	0.0000	2537335785.0	195179675.8	126866789.3
27	0.000	0.000	0.0000	0.0000	0.0000	4707300620.3	362100047.7	235365031.0
28	0.000	0.000	0.0000	0.0000	0.0000	8733049547.5	671773042.1	436652477.4
29	0.000	0.000	0.0000	0.0000	0.0000	16201674920.0	1246282686.2	810083746.0
30	0.000	0.000	0.0000	0.0000	0.0000	30057572533.3	2312120964.1	1502878626.7

Occupational Post-Application Risk Assessment Calculator Version 1 (8/9/00)

Chemical:	Diazinon Short-term Assessment
Reason:	TC Policy 3.1
Date:	10/25/00
Transfer Coefficient Group:	Field/row crop, low/medium
Specific Crop(s) Considered:	beans, peas
Application Rate of Crop (lb ai/A):	0.75

DFR Data Summary

Data Source (enter 1 if data available, 0 if defaults):	1
Source:	Cabbage DFR Data (MRID 402029-02)
Slope of Semilog Regression:	-0.618
[Initial] (ug/cm2):	0.164
Study Application Rate (lb ai/A):	0.5
Limit of Quantification (ug/cm2):	0.002

Exposure Inputs Summary

Exposure Potential	Transfer Coefficients (cm2/hour)		Activities
	Used For RA	Range	
Very Low	N/A	N/A	N/A
Low	100	TBD	Irrigation, scouting, thinning, weeding immature/low foliage plants
Medium	1500	486 to 2760	Irrigation, scouting, weeding mature/high foliage plants
High	2500	486 to 2760	hand harvesting
Very High	N/A	N/A	N/A

DAT	DFR LEVELS (ug/cm2)		DOSE (mg/kg/day)			MOES		
	Not Adjusted	Adjusted For Rate	Low Exposure	Medium Exposure	High Exposure	Low Exposure	Medium Exposure	High Exposure
0	0.164	0.246	0.0028	0.0422	0.0703	355.7	23.7	14.2
1	0.088	0.133	0.0015	0.0227	0.0379	659.9	44.0	26.4
2	0.048	0.071	0.0008	0.0123	0.0204	1224.2	81.6	49.0
3	0.026	0.039	0.0004	0.0066	0.0110	2271.2	151.4	90.8
4	0.014	0.021	0.0002	0.0036	0.0059	4213.6	280.9	168.5
5	0.007	0.011	0.0001	0.0019	0.0032	7817.1	521.1	312.7
6	0.004	0.006	0.0001	0.0010	0.0017	14502.3	966.8	580.1
7	0.002	0.003	0.0000	0.0006	0.0009	26904.9	1793.7	1076.2
8	0.001	0.002	0.0000	0.0003	0.0005	49914.3	3327.6	1996.6
9	0.001	0.001	0.0000	0.0002	0.0003	92601.7	6173.4	3704.1
10	0.000	0.001	0.0000	0.0001	0.0001	171795.9	11453.1	6871.8
11	0.000	0.000	0.0000	0.0000	0.0001	318718.2	21247.9	12748.7
12	0.000	0.000	0.0000	0.0000	0.0000	591290.4	39419.4	23651.6
13	0.000	0.000	0.0000	0.0000	0.0000	1096970.2	73131.3	43878.8
14	0.000	0.000	0.0000	0.0000	0.0000	2035114.3	135674.3	81404.6
15	0.000	0.000	0.0000	0.0000	0.0000	3775572.3	251704.8	151022.9
16	0.000	0.000	0.0000	0.0000	0.0000	7004494.2	466966.3	280179.8
17	0.000	0.000	0.0000	0.0000	0.0000	12994835.1	866322.3	519793.4
18	0.000	0.000	0.0000	0.0000	0.0000	24108198.7	1607213.2	964327.9
19	0.000	0.000	0.0000	0.0000	0.0000	44725865.4	2981724.4	1789034.6
20	0.000	0.000	0.0000	0.0000	0.0000	82976047.2	5531736.5	3319041.9
21	0.000	0.000	0.0000	0.0000	0.0000	153938316.3	10262554.4	6157532.7
22	0.000	0.000	0.0000	0.0000	0.0000	285588504.3	19039233.6	11423540.2
23	0.000	0.000	0.0000	0.0000	0.0000	529827763.1	35321850.9	21193110.5
24	0.000	0.000	0.0000	0.0000	0.0000	982943831.3	65529588.8	39317753.3

25	0.000	0.000	0.0000	0.0000	0.0000	1823571059.9	121571404.0	72942842.4
26	0.000	0.000	0.0000	0.0000	0.0000	3383114380.0	225540958.7	135324575.2
27	0.000	0.000	0.0000	0.0000	0.0000	6276400827.0	418426721.8	251056033.1
28	0.000	0.000	0.0000	0.0000	0.0000	11644066063.4	776271070.9	465762642.5
29	0.000	0.000	0.0000	0.0000	0.0000	21602233226.6	1440148881.8	864089329.1
30	0.000	0.000	0.0000	0.0000	0.0000	40076763377.7	2671784225.2	1603070535.1

Chemical: Diazinon Short-term Assessment
Reason: TC Policy 3.1
Date: 10/10/00
Transfer Coefficient Group: Field/row crop, tall
Specific Crop(s) Considered: Corn, sorghum, sweetcorn
Application Rate of Crop (lb ai/A): 1.25

DFR Data Summary

Data Source (enter 1 if data available, 0 if defaults):	1
Source:	Cabbage (MRID 402029-02)
Slope of Semilog Regression:	-0.618
[Initial] (ug/cm2):	0.164
Study Application Rate (lb ai/A):	0.5
Limit of Quantification (ug/cm2):	0.002

Exposure Inputs Summary

Exposure Potential	Transfer Coefficients (cm2/hour)		Activities	
	Used For RA	Range		
Very Low	N/A	N/A	N/A	
Low	100	TBD	scouting, weeding	immature/low foliage plants
Medium	400	418 to 1980	scouting, weeding	more mature/foliaged plants
High	1000	418 to 1980	scouting, irrigation, weeding	mature/full foliage plants
Very High	17000	6748 to 25254	sweetcorn hand harvest or detasseling	

DAT	DFR LEVELS (ug/cm2)		DOSE (mg/kg/day)				MOES			
	Not Adjusted	Adjusted For Rate	Low Exposure	Medium Exposure	High Exposure	Very High Exposure	Low Exposure	Medium Exposure	High Exposure	Very High Exposure
0	0.164	0.410	0.0047	0.0187	0.0469	0.7966	213.4	53.4	21.3	1.3
1	0.088	0.221	0.0025	0.0101	0.0253	0.4294	395.9	99.0	39.6	2.3
2	0.048	0.119	0.0014	0.0054	0.0136	0.2314	734.5	183.6	73.5	4.3
3	0.026	0.064	0.0007	0.0029	0.0073	0.1248	1362.7	340.7	136.3	8.0
4	0.014	0.035	0.0004	0.0016	0.0040	0.0672	2528.1	632.0	252.8	14.9
5	0.007	0.019	0.0002	0.0009	0.0021	0.0362	4690.2	1172.6	469.0	27.6
6	0.004	0.010	0.0001	0.0005	0.0011	0.0195	8701.4	2175.3	870.1	51.2
7	0.002	0.005	0.0001	0.0002	0.0006	0.0105	16142.9	4035.7	1614.3	95.0
8	0.001	0.003	0.0000	0.0001	0.0003	0.0057	29948.6	7487.1	2994.9	176.2
9	0.001	0.002	0.0000	0.0001	0.0002	0.0031	55561.0	13890.3	5556.1	326.8
10	0.000	0.001	0.0000	0.0000	0.0001	0.0016	103077.6	25769.4	10307.8	606.3
11	0.000	0.000	0.0000	0.0000	0.0001	0.0009	191230.9	47807.7	19123.1	1124.9
12	0.000	0.000	0.0000	0.0000	0.0000	0.0005	354774.2	88693.6	35477.4	2086.9
13	0.000	0.000	0.0000	0.0000	0.0000	0.0003	658182.1	164545.5	65818.2	3871.7
14	0.000	0.000	0.0000	0.0000	0.0000	0.0001	1221068.6	305267.1	122106.9	7182.8
15	0.000	0.000	0.0000	0.0000	0.0000	0.0001	2265343.4	566335.8	226534.3	13325.5
16	0.000	0.000	0.0000	0.0000	0.0000	0.0000	4202696.5	1050674.1	420269.7	24721.7
17	0.000	0.000	0.0000	0.0000	0.0000	0.0000	7796901.1	1949225.3	779690.1	45864.1
18	0.000	0.000	0.0000	0.0000	0.0000	0.0000	14464919.2	3616229.8	1446491.9	85087.8
19	0.000	0.000	0.0000	0.0000	0.0000	0.0000	26835519.2	6708879.8	2683551.9	157856.0
20	0.000	0.000	0.0000	0.0000	0.0000	0.0000	49785628.3	12446407.1	4978562.8	292856.6

21	0.000	0.000	0.0000	0.0000	0.0000	0.0000	92362989.8	23090747.40	9236299.0	543311.7
22	0.000	0.000	0.0000	0.0000	0.0000	0.0000	1713531026.6	42838275.6	1713531.3	100795.4
23	0.000	0.000	0.0000	0.0000	0.0000	0.0000	3178966579.9	794741645	317896658.8	18699803
24	0.000	0.000	0.0000	0.0000	0.0000	0.0000	589766298.8	147441574.7	58976629.9	3469213.5
25	0.000	0.000	0.0000	0.0000	0.0000	0.0000	1094142635.9	273535659.0	10941426 3.6	6436133.2
26	0.000	0.000	0.0000	0.0000	0.0000	0.0000	2029868628.0	507467157.0	2029868 62.8	1194040 3.7
27	0.000	0.000	0.0000	0.0000	0.0000	0.0000	3765840496.2	941460124.1	376584049.6	2215200 2.9
28	0.000	0.000	0.0000	0.0000	0.0000	0.0000	6986439638.0	1746609909.5	698643963.8	4109670 3.8
29	0.000	0.000	0.0000	0.0000	0.0000	0.0000	1296133936.0	324033498 4.0	129613399 3.6	7624317 6.1
30	0.000	0.000	0.0000	0.0000	0.0000	0.0000	2404658026.6	601151450 6.7	240460580 2.7	1414474 00.2

Occupational Post-Application Risk Assessment Calculator Version 1 (8/9/00)

Chemical:	Diazinon Short-term Assessment
Reason:	TC Policy 3.1
Date:	10/25/00
Transfer Coefficient Group:	Cut Flowers
Specific Crop(s) Considered:	Floriculture Crops
Application Rate of Crop (lb ai/A):	2

DFR Data Summary

Data Source (enter 1 if data available, 0 if defaults):	1
Source:	Cabbage DFR data (MRID 402029-02)
Slope of Semilog Regression:	-0.618
[Initial] (ug/cm2):	0.164
Study Application Rate (lb ai/A):	0.5
Limit of Quantification (ug/cm2):	0.002

Exposure Inputs Summary

Exposure Potential	Transfer Coefficients (cm2/hour)		Activities
	Used For RA	Range	
Very Low	N/A	N/A	N/A
Low	2500	2400 to 13000	Irrigation, scouting, thinning, weeding immature/low foliage plants
Medium	4000	2400 to 13000	Irrigation, scouting mature/high foliage plants
High	7000	2400 to 13000	hand harvesting, pruning, thinning, pinching
Very High	N/A	N/A	N/A

DAT	DFR LEVELS (ug/cm2)		DOSE (mg/kg/day)			MOES		
	Not Adjusted	Adjusted For Rate	Low Exposure	Medium Exposure	High Exposure	Low Exposure	Medium Exposure	High Exposure
0	0.164	0.656	0.1874	0.2999	0.5248	5.3	3.3	1.9
1	0.088	0.354	0.1010	0.1616	0.2829	9.9	6.2	3.5
2	0.048	0.191	0.0545	0.0871	0.1525	18.4	11.5	6.6
3	0.026	0.103	0.0294	0.0470	0.0822	34.1	21.3	12.2
4	0.014	0.055	0.0158	0.0253	0.0443	63.2	39.5	22.6
5	0.007	0.030	0.0085	0.0136	0.0239	117.3	73.3	41.9
6	0.004	0.016	0.0046	0.0074	0.0129	217.5	136.0	77.7
7	0.002	0.009	0.0025	0.0040	0.0069	403.6	252.2	144.1
8	0.001	0.005	0.0013	0.0021	0.0037	748.7	467.9	267.4
9	0.001	0.003	0.0007	0.0012	0.0020	1389.0	868.1	496.1
10	0.000	0.001	0.0004	0.0006	0.0011	2576.9	1610.6	920.3
11	0.000	0.001	0.0002	0.0003	0.0006	4780.8	2988.0	1707.4
12	0.000	0.000	0.0001	0.0002	0.0003	8869.4	5543.3	3167.6
13	0.000	0.000	0.0001	0.0001	0.0002	16454.6	10284.1	5876.6
14	0.000	0.000	0.0000	0.0001	0.0001	30526.7	19079.2	10902.4
15	0.000	0.000	0.0000	0.0000	0.0000	56633.6	35396.0	20226.3
16	0.000	0.000	0.0000	0.0000	0.0000	105067.4	65667.1	37524.1
17	0.000	0.000	0.0000	0.0000	0.0000	194922.5	121826.6	69615.2
18	0.000	0.000	0.0000	0.0000	0.0000	361623.0	226014.4	129151.1
19	0.000	0.000	0.0000	0.0000	0.0000	670888.0	419305.0	239602.9
20	0.000	0.000	0.0000	0.0000	0.0000	1244640.7	777900.4	444514.5
21	0.000	0.000	0.0000	0.0000	0.0000	2309074.7	1443171.7	824669.6
22	0.000	0.000	0.0000	0.0000	0.0000	4283827.6	2677392.2	1529938.4

23	0.000	0.000	0.0000	0.0000	0.0000	7947416.4	4967135.3	2838363.0
24	0.000	0.000	0.0000	0.0000	0.0000	14744157.5	9215098.4	5265770.5
25	0.000	0.000	0.0000	0.0000	0.0000	27353565.9	17095978.7	9769130.7
26	0.000	0.000	0.0000	0.0000	0.0000	50746715.7	31716697.3	18123827.0
27	0.000	0.000	0.0000	0.0000	0.0000	94146012.4	58841257.8	33623575.9
28	0.000	0.000	0.0000	0.0000	0.0000	174660991.0	109163119.3	62378925.3
29	0.000	0.000	0.0000	0.0000	0.0000	324033498.4	202520936.5	115726249.4
30	0.000	0.000	0.0000	0.0000	0.0000	601151450.7	375719656.7	214696946.7

Chemical:	Diazinon
Reason:	TC Policy 3.1
Date:	10/10/00
Transfer Coefficient Group:	Deciduous Tree Fruit
Specific Crop(s) Considered:	Apples, apricots, cherries, figs, nectarines, peaches, pears, plums
Application Rate of Crop (lb ai/A):	2

DFR Data Summary

Data Source (enter 1 if data available, 0 if defaults):	1
Source:	Citrus DFR Data (MRID 404666-01)
Slope of Semilog Regression:	-0.2682
[Initial] (ug/cm2):	0.04
Study Application Rate (lb ai/A):	1
Limit of Quantification (ug/cm2):	0.004

Exposure Inputs Summary

Exposure Potential	Transfer Coefficients (cm2/hour)		Activities
	Used For RA	Range	
Very Low	100	100	propping
Low	1000	197 to 2302	Irrigation, scouting, weeding
Medium	N/A	N/A	N/A
High	3000	1421 to 4393	harvesting, pruning, training, tying
Very High	8000	5806 to 9835	thinning

DAT	DFR LEVELS (ug/cm2)		DOSE (mg/kg/day)				MOEs			
	Not Adjusted	Adjusted For Rate	Very Low Exposure	Low Exposure	High Exposure	Very High Exposure	Very Low Exposure	Low Exposure	High Exposure	Very High Exposure
0	0.040	0.080	0.0009	0.009	0.027	0.073	1093.8	109.4	36.5	13.7
1	0.031	0.061	0.0007	0.007	0.021	0.056	1430.2	143.0	47.7	17.9
2	0.023	0.047	0.0005	0.005	0.016	0.043	1870.1	187.0	62.3	23.4
3	0.018	0.036	0.0004	0.004	0.012	0.033	2445.4	244.5	81.5	30.6
4	0.014	0.027	0.0003	0.003	0.009	0.025	3197.6	319.8	106.6	40.0
5	0.010	0.021	0.0002	0.002	0.007	0.019	4181.3	418.1	139.4	52.3
6	0.008	0.016	0.0002	0.002	0.005	0.015	5467.4	546.7	182.2	68.3
7	0.006	0.012	0.0001	0.001	0.004	0.011	7149.3	714.9	238.3	89.4
8	0.005	0.009	0.0001	0.001	0.003	0.009	9348.5	934.8	311.6	116.9
9	0.004	0.007	0.0001	0.001	0.002	0.007	12224.1	1222.4	407.5	152.8
10	0.003	0.005	0.0001	0.001	0.002	0.005	15984.4	1598.4	532.8	199.8
11	0.002	0.004	0.0000	0.000	0.001	0.004	20901.3	2090.1	696.7	261.3
12	0.002	0.003	0.0000	0.000	0.001	0.003	27330.7	2733.1	911.0	341.6
13	0.001	0.002	0.0000	0.000	0.001	0.002	35737.9	3573.8	1191.3	446.7
14	0.001	0.002	0.0000	0.000	0.001	0.002	46731.2	4673.1	1557.7	584.1
15	0.001	0.001	0.0000	0.000	0.000	0.001	61106.1	6110.6	2036.9	763.8
16	0.001	0.001	0.0000	0.000	0.000	0.001	79902.9	7990.3	2663.4	998.8
17	0.000	0.001	0.0000	0.000	0.000	0.001	104481.7	10448.2	3482.7	1306.0
18	0.000	0.001	0.0000	0.000	0.000	0.001	136621.2	13662.1	4554.0	1707.8
19	0.000	0.000	0.0000	0.000	0.000	0.000	178647.1	17864.7	5954.9	2233.1
20	0.000	0.000	0.0000	0.000	0.000	0.000	233600.4	23360.0	7786.7	2920.0
21	0.000	0.000	0.0000	0.000	0.000	0.000	305458.0	30545.8	10181.9	3818.2
22	0.000	0.000	0.0000	0.000	0.000	0.000	399419.5	39941.9	13314.0	4992.7
23	0.000	0.000	0.0000	0.000	0.000	0.000	522284.3	52228.4	17409.5	6528.6
24	0.000	0.000	0.0000	0.000	0.000	0.000	682943.5	68294.4	22764.8	8536.8
25	0.000	0.000	0.0000	0.000	0.000	0.000	893022.8	89302.3	29767.4	11162.8
26	0.000	0.000	0.0000	0.000	0.000	0.000	1167724.4	116772.4	38924.1	14596.6

27	0.000	0.000	0.0000	0.000	0.000	0.000	1526926.5	152692.6	50897.5	19086.6
28	0.000	0.000	0.0000	0.000	0.000	0.000	1996622.3	199662.2	66554.1	24957.8
29	0.000	0.000	0.0000	0.000	0.000	0.000	2610800.5	261080.1	87026.7	32635.0
30	0.000	0.000	0.0000	0.000	0.000	0.000	3413905.3	341390.5	113796.8	42673.8

Occupational Post-Application Risk Assessment Calculator Version 1 (8/9/00)

Chemical:	Diazinon
Reason:	TC Policy 3.1
Date:	10/10/00
Transfer Coefficient Group:	Tree Nut
Specific Crop(s) Considered:	Almonds
Application Rate of Crop (lb ai/A):	3

DFR Data Summary

Data Source (enter 1 if data available, 0 if defaults):	1
Source:	Citrus DFR Data (MRID 404666-01)
Slope of Semilog Regression:	-0.06621
[Initial] (ug/cm2):	0.04
Study Application Rate (lb ai/A):	1
Limit of Quantification (ug/cm2):	0.004

Exposure Inputs Summary

Exposure Potential	Transfer Coefficients (cm2/hour)		Activities
	Used For RA	Range	
Very Low	N/A	N/A	N/A
Low	500	197 to 2302	Irrigation, scouting, thinning, weeding
Medium	N/A	N/A	N/A
High	2500	1121 to 4929	harvesting/poling, pruning, thinning
Very High	N/A	N/A	N/A

[Note: Mechanical shaking, rowing/sweeping, and vacuuming are a special concern and are not addressed with TCs.]

DAT	DFR LEVELS (ug/cm2)		DOSE (mg/kg/day)		MOEs	
	Not Adjusted	Adjusted For Rate	Low Exposure	High Exposure	Low Exposure	High Exposure
0	0.040	0.120	0.007	0.034	145.8	29.2
1	0.037	0.112	0.006	0.032	155.8	31.2
2	0.035	0.105	0.006	0.030	166.5	33.3
3	0.033	0.098	0.006	0.028	177.9	35.6
4	0.031	0.092	0.005	0.026	190.1	38.0
5	0.029	0.086	0.005	0.025	203.1	40.6
6	0.027	0.081	0.005	0.023	217.0	43.4
7	0.025	0.075	0.004	0.022	231.8	46.4
8	0.024	0.071	0.004	0.020	247.7	49.5
9	0.022	0.066	0.004	0.019	264.6	52.9
10	0.021	0.062	0.004	0.018	282.8	56.6
11	0.019	0.058	0.003	0.017	302.1	60.4
12	0.018	0.054	0.003	0.015	322.8	64.6
13	0.017	0.051	0.003	0.014	344.9	69.0
14	0.016	0.047	0.003	0.014	368.5	73.7
15	0.015	0.044	0.003	0.013	393.7	78.7
16	0.014	0.042	0.002	0.012	420.7	84.1
17	0.013	0.039	0.002	0.011	449.5	89.9
18	0.012	0.036	0.002	0.010	480.2	96.0
19	0.011	0.034	0.002	0.010	513.1	102.6
20	0.011	0.032	0.002	0.009	548.2	109.6
21	0.010	0.030	0.002	0.009	585.7	117.1
22	0.009	0.028	0.002	0.008	625.8	125.2
23	0.009	0.026	0.001	0.007	668.7	133.7
24	0.008	0.024	0.001	0.007	714.4	142.9
25	0.008	0.023	0.001	0.007	763.3	152.7
26	0.007	0.021	0.001	0.006	815.6	163.1

27	0.007	0.020	0.001	0.006	871.4	174.3
28	0.006	0.019	0.001	0.005	931.1	186.2
29	0.006	0.018	0.001	0.005	994.8	199.0
30	0.005	0.016	0.001	0.005	1062.9	212.6

Occupational Post-Application Risk Assessment Calculator Version 1 (8/9/00)

Chemical:	Diazinon	
Reason:		TC Policy 3.1
Date:	10/25/00	
Transfer Coefficient Group:		Root Vegetables
Specific Crop(s) Considered:		beets, carrots, onions, parsnips, potatoes, radishes
Application Rate of Crop (lb ai/A):	0.5	

DFR Data Summary

Data Source (enter 1 if data available, 0 if defaults):	1	
Source:		Cabbage (MRID 402029-02)
Slope of Semilog Regression:	-0.618	
[Initial] (ug/cm2):	0.164	
Study Application Rate (lb ai/A):	0.5	
Limit of Quantification (ug/cm2):	0.002	

Exposure Inputs Summary

Exposure Potential	Transfer Coefficients (cm2/hour)		Activities
	Used For RA	Range	
Very Low	N/A	N/A	N/A
Low	300	140 to 290	Irrigation, scouting, thinning, weeding immature plants
Medium	1500	486 to 2760	Irrigation and scouting mature plants
High	2500	486 to 2760	hand harvesting
Very High	N/A	N/A	N/A

DAT	DFR LEVELS (ug/cm2)		DOSE (mg/kg/day)			MOES		
	Not Adjusted	Adjusted For Rate	Low Exposure	Medium Exposure	High Exposure	Low Exposure	Medium Exposure	High Exposure
0	0.164	0.164	0.0056	0.0281	0.0469	177.8	35.6	21.3
1	0.088	0.088	0.0030	0.0152	0.0253	329.9	66.0	39.6
2	0.048	0.048	0.0016	0.0082	0.0136	612.1	122.4	73.5
3	0.026	0.026	0.0009	0.0044	0.0073	1135.6	227.1	136.3
4	0.014	0.014	0.0005	0.0024	0.0040	2106.8	421.4	252.8
5	0.007	0.007	0.0003	0.0013	0.0021	3908.5	781.7	469.0
6	0.004	0.004	0.0001	0.0007	0.0011	7251.1	1450.2	870.1
7	0.002	0.002	0.0001	0.0004	0.0006	13452.4	2690.5	1614.3
8	0.001	0.001	0.0000	0.0002	0.0003	24957.1	4991.4	2994.9
9	0.001	0.001	0.0000	0.0001	0.0002	46300.8	9260.2	5556.1
10	0.000	0.000	0.0000	0.0001	0.0001	85898.0	17179.6	10307.8
11	0.000	0.000	0.0000	0.0000	0.0001	159359.1	31871.8	19123.1
12	0.000	0.000	0.0000	0.0000	0.0000	295645.2	59129.0	35477.4
13	0.000	0.000	0.0000	0.0000	0.0000	548485.1	109697.0	65818.2
14	0.000	0.000	0.0000	0.0000	0.0000	1017557.1	203511.4	122106.9
15	0.000	0.000	0.0000	0.0000	0.0000	1887786.2	377557.2	226534.3
16	0.000	0.000	0.0000	0.0000	0.0000	3502247.1	700449.4	420269.7
17	0.000	0.000	0.0000	0.0000	0.0000	6497417.5	1299483.5	779690.1
18	0.000	0.000	0.0000	0.0000	0.0000	12054099.4	2410819.9	1446491.9
19	0.000	0.000	0.0000	0.0000	0.0000	22362932.7	4472586.5	2683551.9
20	0.000	0.000	0.0000	0.0000	0.0000	41488023.6	8297604.7	4978562.8
21	0.000	0.000	0.0000	0.0000	0.0000	76969158.1	15393831.6	9236299.0
22	0.000	0.000	0.0000	0.0000	0.0000	142794252.1	28558850.4	17135310.3
23	0.000	0.000	0.0000	0.0000	0.0000	264913881.6	52982776.3	31789665.8
24	0.000	0.000	0.0000	0.0000	0.0000	491471915.7	98294383.1	58976629.9
25	0.000	0.000	0.0000	0.0000	0.0000	911785529.9	182357106.0	109414263.6
26	0.000	0.000	0.0000	0.0000	0.0000	1691557190.0	338311438.0	202986862.8
27	0.000	0.000	0.0000	0.0000	0.0000	3138200413.5	627640082.7	376584049.6

28	0.000	0.000	0.0000	0.0000	0.0000	5822033031.7	1164406606.3	698643963.8
29	0.000	0.000	0.0000	0.0000	0.0000	10801116613.3	2160223322.7	1296133993.6
30	0.000	0.000	0.0000	0.0000	0.0000	20038381688.9	4007676337.8	2404605802.7

Occupational Post-Application Risk Assessment Calculator Version 1 (8/9/00)

Chemical:	Diazinon
Reason:	TC Policy 3.1
Date:	10/25/00
Transfer Coefficient Group:	Cucurbit Vegetables
Specific Crop(s) Considered:	cucumbers, melons
Application Rate of Crop (lb ai/A):	0.75

DFR Data Summary

Data Source (enter 1 if data available, 0 if defaults):	1
Source:	Cabbage (MRID 402029-02)
Slope of Semilog Regression:	-0.618
[Initial] (ug/cm2):	0.164
Study Application Rate (lb ai/A):	0.5
Limit of Quantification (ug/cm2):	0.002

Exposure Inputs Summary

Exposure Potential	Transfer Coefficients (cm2/hour)		Activities
	Used For RA	Range	
Very Low	N/A	N/A	N/A
Low	500	486 to 2760	Irrigation, scouting, thinning, weeding immature plants
Medium	1500	486 to 2760	Irrigation, scouting, weeding mature plants
High	2500	486 to 2760	hand harvesting, pulling, leaf thinning, thinning, turning
Very High	N/A	N/A	N/A

DAT	DFR LEVELS (ug/cm2)		DOSE (mg/kg/day)			MOES		
	Not Adjusted	Adjusted For Rate	Low Exposure	Medium Exposure	High Exposure	Low Exposure	Medium Exposure	High Exposure
0	0.164	0.246	0.0141	0.0422	0.0703	71.1	23.7	14.2
1	0.088	0.133	0.0076	0.0227	0.0379	132.0	44.0	26.4
2	0.048	0.071	0.0041	0.0123	0.0204	244.8	81.6	49.0
3	0.026	0.039	0.0022	0.0066	0.0110	454.2	151.4	90.8
4	0.014	0.021	0.0012	0.0036	0.0059	842.7	280.9	168.5
5	0.007	0.011	0.0006	0.0019	0.0032	1563.4	521.1	312.7
6	0.004	0.006	0.0003	0.0010	0.0017	2900.5	966.8	580.1
7	0.002	0.003	0.0002	0.0006	0.0009	5381.0	1793.7	1076.2
8	0.001	0.002	0.0001	0.0003	0.0005	9982.9	3327.6	1996.6
9	0.001	0.001	0.0001	0.0002	0.0003	18520.3	6173.4	3704.1
10	0.000	0.001	0.0000	0.0001	0.0001	34359.2	11453.1	6871.8
11	0.000	0.000	0.0000	0.0000	0.0001	63743.6	21247.9	12748.7
12	0.000	0.000	0.0000	0.0000	0.0000	118258.1	39419.4	23651.6
13	0.000	0.000	0.0000	0.0000	0.0000	219394.0	73131.3	43878.8
14	0.000	0.000	0.0000	0.0000	0.0000	407022.9	135674.3	81404.6
15	0.000	0.000	0.0000	0.0000	0.0000	755114.5	251704.8	151022.9
16	0.000	0.000	0.0000	0.0000	0.0000	1400898.8	466966.3	280179.8
17	0.000	0.000	0.0000	0.0000	0.0000	2598967.0	866322.3	519793.4
18	0.000	0.000	0.0000	0.0000	0.0000	4821639.7	1607213.2	964327.9
19	0.000	0.000	0.0000	0.0000	0.0000	8945173.1	2981724.4	1789034.6
20	0.000	0.000	0.0000	0.0000	0.0000	16595209.4	5531736.5	3319041.9
21	0.000	0.000	0.0000	0.0000	0.0000	30787663.3	10262554.4	6157532.7
22	0.000	0.000	0.0000	0.0000	0.0000	57117700.9	19039233.6	11423540.2
23	0.000	0.000	0.0000	0.0000	0.0000	105965552.6	35321850.9	21193110.5
24	0.000	0.000	0.0000	0.0000	0.0000	196588766.3	65529588.8	39317753.3
25	0.000	0.000	0.0000	0.0000	0.0000	364714212.0	121571404.0	72942842.4
26	0.000	0.000	0.0000	0.0000	0.0000	676622876.0	225540958.7	135324575.2
27	0.000	0.000	0.0000	0.0000	0.0000	1255280165.4	418426721.8	251056033.1

28	0.000	0.000	0.0000	0.0000	0.0000	2328813212.7	776271070.9	465762642.5
29	0.000	0.000	0.0000	0.0000	0.0000	4320446645.3	1440148881.8	864089329.1
30	0.000	0.000	0.0000	0.0000	0.0000	8015352675.5	2671784225.2	1603070535.1

Occupational Post-Application Risk Assessment Calculator Version 1 (8/9/00)

Chemical:	Diazinon
Reason:	TC Policy 3.1
Date:	10/25/00
Transfer Coefficient Group:	Fruiting Vegetables
Specific Crop(s) Considered:	peppers, tomatoes
Application Rate of Crop (lb ai/A):	0.75

DFR Data Summary

Data Source (enter 1 if data available, 0 if defaults):	1
Source:	Cabbage (MRID 402029-02)
Slope of Semilog Regression:	-0.618
[Initial] (ug/cm2):	0.164
Study Application Rate (lb ai/A):	0.5
Limit of Quantification (ug/cm2):	0.002

Exposure Inputs Summary

Exposure Potential	Transfer Coefficients (cm2/hour)		Activities
	Used For RA	Range	
Very Low	N/A	N/A	N/A
Low	500	486 to 2760	Irrigation, scouting, thinning, weeding immature plants
Medium	700	TBD	Irrigation and scouting mature plants
High	1000	364 to 1908	hand harvesting, pruning, staking, tying
Very High	N/A	N/A	N/A

DAT	DFR LEVELS (ug/cm2)		DOSE (mg/kg/day)			MOES		
	Not Adjusted	Adjusted For Rate	Low Exposure	Medium Exposure	High Exposure	Low Exposure	Medium Exposure	High Exposure
0	0.164	0.246	0.0141	0.0197	0.0281	71.1	50.8	35.6
1	0.088	0.133	0.0076	0.0106	0.0152	132.0	94.3	66.0
2	0.048	0.071	0.0041	0.0057	0.0082	244.8	174.9	122.4
3	0.026	0.039	0.0022	0.0031	0.0044	454.2	324.5	227.1
4	0.014	0.021	0.0012	0.0017	0.0024	842.7	601.9	421.4
5	0.007	0.011	0.0006	0.0009	0.0013	1563.4	1116.7	781.7
6	0.004	0.006	0.0003	0.0005	0.0007	2900.5	2071.8	1450.2
7	0.002	0.003	0.0002	0.0003	0.0004	5381.0	3843.6	2690.5
8	0.001	0.002	0.0001	0.0001	0.0002	9982.9	7130.6	4991.4
9	0.001	0.001	0.0001	0.0001	0.0001	18520.3	13228.8	9260.2
10	0.000	0.001	0.0000	0.0000	0.0001	34359.2	24542.3	17179.6
11	0.000	0.000	0.0000	0.0000	0.0000	63743.6	45531.2	31871.8
12	0.000	0.000	0.0000	0.0000	0.0000	118258.1	84470.1	59129.0
13	0.000	0.000	0.0000	0.0000	0.0000	219394.0	156710.0	109697.0
14	0.000	0.000	0.0000	0.0000	0.0000	407022.9	290730.6	203511.4
15	0.000	0.000	0.0000	0.0000	0.0000	755114.5	539367.5	377557.2
16	0.000	0.000	0.0000	0.0000	0.0000	1400898.8	1000642.0	700449.4
17	0.000	0.000	0.0000	0.0000	0.0000	2598967.0	1856405.0	1299483.5
18	0.000	0.000	0.0000	0.0000	0.0000	4821639.7	3444028.4	2410819.9
19	0.000	0.000	0.0000	0.0000	0.0000	8945173.1	6389409.3	4472586.5
20	0.000	0.000	0.0000	0.0000	0.0000	16595209.4	11853721.0	8297604.7
21	0.000	0.000	0.0000	0.0000	0.0000	30787663.3	21991188.0	15393831.6
22	0.000	0.000	0.0000	0.0000	0.0000	57117700.9	40798357.8	28558850.4
23	0.000	0.000	0.0000	0.0000	0.0000	105965552.6	75689680.4	52982776.3
24	0.000	0.000	0.0000	0.0000	0.0000	196588766.3	140420547.3	98294383.1
25	0.000	0.000	0.0000	0.0000	0.0000	364714212.0	260510151.4	182357106.0
26	0.000	0.000	0.0000	0.0000	0.0000	676622876.0	483302054.3	338311438.0
27	0.000	0.000	0.0000	0.0000	0.0000	1255280165.4	896628689.6	627640082.7

28	0.000	0.000	0.0000	0.0000	0.0000	2328813212.7	1663438009.1	1164406606.3
29	0.000	0.000	0.0000	0.0000	0.0000	4320446645.3	3086033318.1	2160223322.7
30	0.000	0.000	0.0000	0.0000	0.0000	8015352675.5	5725251911.1	4007676337.8

Occupational Post-Application Risk Assessment Calculator Version 1 (8/9/00)

Chemical:	Diazinon	
Reason:		TC Policy 3.1
Date:	10/25/00	
Transfer Coefficient Group:	Brassica	
Specific Crop(s) Considered:	cole crops	
Application Rate of Crop (lb ai/A):	0.5	

DFR Data Summary

Data Source (enter 1 if data available, 0 if defaults):	1	
Source:		Cabbage (MRID 402029-02)
Slope of Semilog Regression:	-0.618	
[Initial] (ug/cm2):	0.164	
Study Application Rate (lb ai/A):	0.5	
Limit of Quantification (ug/cm2):	0.002	

Exposure Inputs Summary

Exposure Potential	Transfer Coefficients (cm2/hour)		Activities
	Used For RA	Range	
Very Low	N/A	N/A	N/A
Low	2000	1672 to 8147	Irrigation, scouting, thinning, weeding immature plants
Medium	4000	1672 to 8147	Scouting mature plants
High	5000	2862 to 7584	Hand harvesting, irrigation, pruning, topping, tying mature plants
Very High	N/A	N/A	N/A

DAT	DFR LEVELS (ug/cm2)		DOSE (mg/kg/day)			MOES		
	Not Adjusted	Adjusted For Rate	Low Exposure	Medium Exposure	High Exposure	Low Exposure	Medium Exposure	High Exposure
0	0.164	0.164	0.0375	0.0750	0.0937	26.7	13.3	10.7
1	0.088	0.088	0.0202	0.0404	0.0505	49.5	24.7	19.8
2	0.048	0.048	0.0109	0.0218	0.0272	91.8	45.9	36.7
3	0.026	0.026	0.0059	0.0117	0.0147	170.3	85.2	68.1
4	0.014	0.014	0.0032	0.0063	0.0079	316.0	158.0	126.4
5	0.007	0.007	0.0017	0.0034	0.0043	586.3	293.1	234.5
6	0.004	0.004	0.0009	0.0018	0.0023	1087.7	543.8	435.1
7	0.002	0.002	0.0005	0.0010	0.0012	2017.9	1008.9	807.1
8	0.001	0.001	0.0003	0.0005	0.0007	3743.6	1871.8	1497.4
9	0.001	0.001	0.0001	0.0003	0.0004	6945.1	3472.6	2778.1
10	0.000	0.000	0.0001	0.0002	0.0002	12884.7	6442.3	5153.9
11	0.000	0.000	0.0000	0.0001	0.0001	23903.9	11951.9	9561.5
12	0.000	0.000	0.0000	0.0000	0.0001	44346.8	22173.4	17738.7
13	0.000	0.000	0.0000	0.0000	0.0000	82272.8	41136.4	32909.1
14	0.000	0.000	0.0000	0.0000	0.0000	152633.6	76316.8	61053.4
15	0.000	0.000	0.0000	0.0000	0.0000	283167.9	141584.0	113267.2
16	0.000	0.000	0.0000	0.0000	0.0000	525337.1	262668.5	210134.8
17	0.000	0.000	0.0000	0.0000	0.0000	974612.6	487306.3	389845.1
18	0.000	0.000	0.0000	0.0000	0.0000	1808114.9	904057.5	723246.0
19	0.000	0.000	0.0000	0.0000	0.0000	3354439.9	1677220.0	1341776.0
20	0.000	0.000	0.0000	0.0000	0.0000	6223203.5	3111601.8	2489281.4
21	0.000	0.000	0.0000	0.0000	0.0000	11545373.7	5772686.9	4618149.5
22	0.000	0.000	0.0000	0.0000	0.0000	21419137.8	10709568.9	8567655.1
23	0.000	0.000	0.0000	0.0000	0.0000	39737082.2	19868541.1	15894832.9
24	0.000	0.000	0.0000	0.0000	0.0000	73720787.3	36860393.7	29488314.9
25	0.000	0.000	0.0000	0.0000	0.0000	136767829.5	68383914.7	54707131.8
26	0.000	0.000	0.0000	0.0000	0.0000	253733578.5	126866789.3	101493431.4
27	0.000	0.000	0.0000	0.0000	0.0000	470730062.0	235365031.0	188292024.8

28	0.000	0.000	0.0000	0.0000	0.0000	873304954.8	436652477.4	349321981.9
29	0.000	0.000	0.0000	0.0000	0.0000	1620167492.0	810083746.0	648066996.8
30	0.000	0.000	0.0000	0.0000	0.0000	3005757253.3	1502878626.7	1202302901.3

Occupational Post-Application Risk Assessment Calculator Version 1 (8/9/00)

Chemical:	Diazinon
Reason:	TC Policy 3.1
Date:	10/25/00
Transfer Coefficient Group:	Leafy Vegetables
Specific Crop(s) Considered:	celery, lettuce, parsley, swiss chard, spinach
Application Rate of Crop (lb ai/A):	0.5

DFR Data Summary

Data Source (enter 1 if data available, 0 if defaults):	1
Source:	Cabbage (MRID 402029-02)
Slope of Semilog Regression:	-0.618
[Initial] (ug/cm2):	0.164
Study Application Rate (lb ai/A):	0.5
Limit of Quantification (ug/cm2):	0.002

Exposure Inputs Summary

Exposure Potential	Transfer Coefficients (cm2/hour)		Activities
	Used For RA	Range	
Very Low	N/A	N/A	N/A
Low	500	486 to 2760	Irrigation, scouting, thinning, weeding immature plants
Medium	1500	486 to 2760	Irrigation and scouting mature plants
High	2500	486 to 2760	Hand harvesting, pruning, and thinning mature plants
Very High	N/A	N/A	N/A

DAT	DFR LEVELS (ug/cm2)		DOSE (mg/kg/day)			MOES		
	Not Adjusted	Adjusted For Rate	Low Exposure	Medium Exposure	High Exposure	Low Exposure	Medium Exposure	High Exposure
0	0.164	0.164	0.0094	0.0281	0.0469	106.7	35.6	21.3
1	0.088	0.088	0.0051	0.0152	0.0253	198.0	66.0	39.6
2	0.048	0.048	0.0027	0.0082	0.0136	367.3	122.4	73.5
3	0.026	0.026	0.0015	0.0044	0.0073	681.4	227.1	136.3
4	0.014	0.014	0.0008	0.0024	0.0040	1264.1	421.4	252.8
5	0.007	0.007	0.0004	0.0013	0.0021	2345.1	781.7	469.0
6	0.004	0.004	0.0002	0.0007	0.0011	4350.7	1450.2	870.1
7	0.002	0.002	0.0001	0.0004	0.0006	8071.5	2690.5	1614.3
8	0.001	0.001	0.0001	0.0002	0.0003	14974.3	4991.4	2994.9
9	0.001	0.001	0.0000	0.0001	0.0002	27780.5	9260.2	5556.1
10	0.000	0.000	0.0000	0.0001	0.0001	51538.8	17179.6	10307.8
11	0.000	0.000	0.0000	0.0000	0.0001	95615.5	31871.8	19123.1
12	0.000	0.000	0.0000	0.0000	0.0000	177387.1	59129.0	35477.4
13	0.000	0.000	0.0000	0.0000	0.0000	329091.0	109697.0	65818.2
14	0.000	0.000	0.0000	0.0000	0.0000	610534.3	203511.4	122106.9
15	0.000	0.000	0.0000	0.0000	0.0000	1132671.7	377557.2	226534.3
16	0.000	0.000	0.0000	0.0000	0.0000	2101348.3	700449.4	420269.7
17	0.000	0.000	0.0000	0.0000	0.0000	3898450.5	1299483.5	779690.1
18	0.000	0.000	0.0000	0.0000	0.0000	7232459.6	2410819.9	1446491.9
19	0.000	0.000	0.0000	0.0000	0.0000	13417759.6	4472586.5	2683551.9
20	0.000	0.000	0.0000	0.0000	0.0000	24892814.2	8297604.7	4978562.8
21	0.000	0.000	0.0000	0.0000	0.0000	46181494.9	15393831.6	9236299.0
22	0.000	0.000	0.0000	0.0000	0.0000	85676551.3	28558850.4	17135310.3
23	0.000	0.000	0.0000	0.0000	0.0000	158948328.9	52982776.3	31789665.8
24	0.000	0.000	0.0000	0.0000	0.0000	294883149.4	98294383.1	58976629.9
25	0.000	0.000	0.0000	0.0000	0.0000	547071318.0	182357106.0	109414263.6
26	0.000	0.000	0.0000	0.0000	0.0000	1014934314.0	338311438.0	202986862.8
27	0.000	0.000	0.0000	0.0000	0.0000	1882920248.1	627640082.7	376584049.6

28	0.000	0.000	0.0000	0.0000	0.0000	3493219819.0	1164406606.3	698643963.8
29	0.000	0.000	0.0000	0.0000	0.0000	6480669968.0	2160223322.7	1296133993.6
30	0.000	0.000	0.0000	0.0000	0.0000	12023029013.3	4007676337.8	2404605802.7

Occupational Post-Application Risk Assessment Calculator Version 1 (8/9/00)

Chemical:	Diazinon	
Reason:		TC Policy 3.1
Date:	10/25/00	
Transfer Coefficient Group:		Leafy Vegetables
Specific Crop(s) Considered:		celery, lettuce, parsley, swiss chard, spinach
Application Rate of Crop (lb ai/A):	0.5	

DFR Data Summary

Data Source (enter 1 if data available, 0 if defaults):	1	
Source:		Cabbage (MRID 402029-02)
Slope of Semilog Regression:	-0.618	
[Initial] (ug/cm2):	0.164	
Study Application Rate (lb ai/A):	0.5	
Limit of Quantification (ug/cm2):	0.002	

Exposure Inputs Summary

Exposure Potential	Transfer Coefficients (cm2/hour)		Activities
	Used For RA	Range	
Very Low	N/A	N/A	N/A
Low	500	486 to 2760	Irrigation, scouting, thinning, weeding immature plants
Medium	1500	486 to 2760	Irrigation and scouting mature plants
High	2500	486 to 2760	Hand harvesting, pruning, and thinning mature plants
Very High	N/A	N/A	N/A

DAT	DFR LEVELS (ug/cm2)		DOSE (mg/kg/day)			MOES		
	Not Adjusted	Adjusted For Rate	Low Exposure	Medium Exposure	High Exposure	Low Exposure	Medium Exposure	High Exposure
0	0.164	0.164	0.0094	0.0281	0.0469	106.7	35.6	21.3
1	0.088	0.088	0.0051	0.0152	0.0253	198.0	66.0	39.6
2	0.048	0.048	0.0027	0.0082	0.0136	367.3	122.4	73.5
3	0.026	0.026	0.0015	0.0044	0.0073	681.4	227.1	136.3
4	0.014	0.014	0.0008	0.0024	0.0040	1264.1	421.4	252.8
5	0.007	0.007	0.0004	0.0013	0.0021	2345.1	781.7	469.0
6	0.004	0.004	0.0002	0.0007	0.0011	4350.7	1450.2	870.1
7	0.002	0.002	0.0001	0.0004	0.0006	8071.5	2690.5	1614.3
8	0.001	0.001	0.0001	0.0002	0.0003	14974.3	4991.4	2994.9
9	0.001	0.001	0.0000	0.0001	0.0002	27780.5	9260.2	5556.1
10	0.000	0.000	0.0000	0.0001	0.0001	51538.8	17179.6	10307.8
11	0.000	0.000	0.0000	0.0000	0.0001	95615.5	31871.8	19123.1
12	0.000	0.000	0.0000	0.0000	0.0000	177387.1	59129.0	35477.4
13	0.000	0.000	0.0000	0.0000	0.0000	329091.0	109697.0	65818.2
14	0.000	0.000	0.0000	0.0000	0.0000	610534.3	203511.4	122106.9
15	0.000	0.000	0.0000	0.0000	0.0000	1132671.7	377557.2	226534.3
16	0.000	0.000	0.0000	0.0000	0.0000	2101348.3	700449.4	420269.7
17	0.000	0.000	0.0000	0.0000	0.0000	3898450.5	1299483.5	779690.1
18	0.000	0.000	0.0000	0.0000	0.0000	7232459.6	2410819.9	1446491.9
19	0.000	0.000	0.0000	0.0000	0.0000	13417759.6	4472586.5	2683551.9
20	0.000	0.000	0.0000	0.0000	0.0000	24892814.2	8297604.7	4978562.8
21	0.000	0.000	0.0000	0.0000	0.0000	46181494.9	15393831.6	9236299.0
22	0.000	0.000	0.0000	0.0000	0.0000	85676551.3	28558850.4	17135310.3
23	0.000	0.000	0.0000	0.0000	0.0000	158948328.9	52982776.3	31789665.8
24	0.000	0.000	0.0000	0.0000	0.0000	294883149.4	98294383.1	58976629.9
25	0.000	0.000	0.0000	0.0000	0.0000	547071318.0	182357106.0	109414263.6
26	0.000	0.000	0.0000	0.0000	0.0000	1014934314.0	338311438.0	202986862.8
27	0.000	0.000	0.0000	0.0000	0.0000	1882920248.	627640082.7	376584049.6

28	0.000	0.000	0.0000	0.0000	0.0000	13493219819.0	1164406606.3	698643963.8
29	0.000	0.000	0.0000	0.0000	0.0000	6480669968.0	2160223322.7	1296133993.6
30	0.000	0.000	0.0000	0.0000	0.0000	12023029013.3	4007676337.8	404605802.7